THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXVIII. No. 1755.] LONDON, DECEMBER 29, 1896. [48TH YEAR. PRICE 6d.

TUBES AND FITTINGS
FOR
GAS, STEAM, WATER,
AND ALL PURPOSES,
ALSO
COILS OF EVERY SIZE AND SHAPE.

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LIMITED,
Imperial Tube Works, Monmore Green,
WOLVERHAMPTON.
ESTABLISHED 1861.

Lanemark Coal Co.,
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LANEMARK CANNEL AND GAS COALS.
Quotations and Analysis on Application to
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NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

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Parker's Imperial Black Varnish,
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Prices and Analysis of all the Scotch Cannels on Application.

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And at Pharos Works, Hackney Wick.
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Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.
Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Pentane, Petroleum Ether, and Naphtha for clearing the pipes of Naphthaline, &c.
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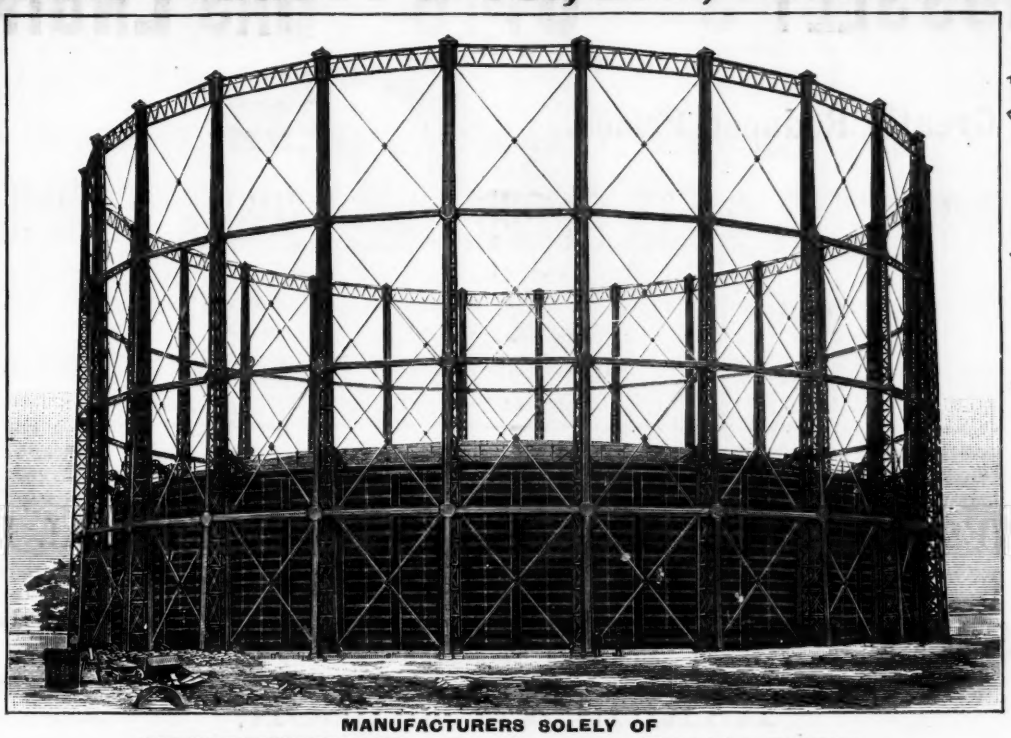

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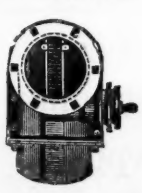

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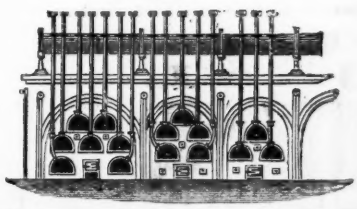

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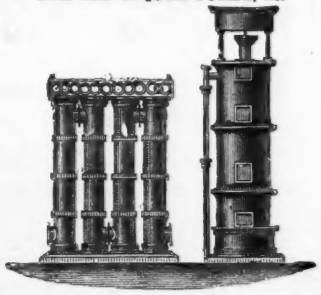

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for working Purifiers,
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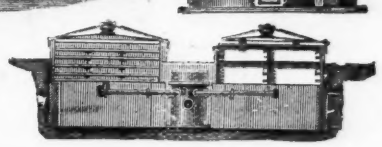

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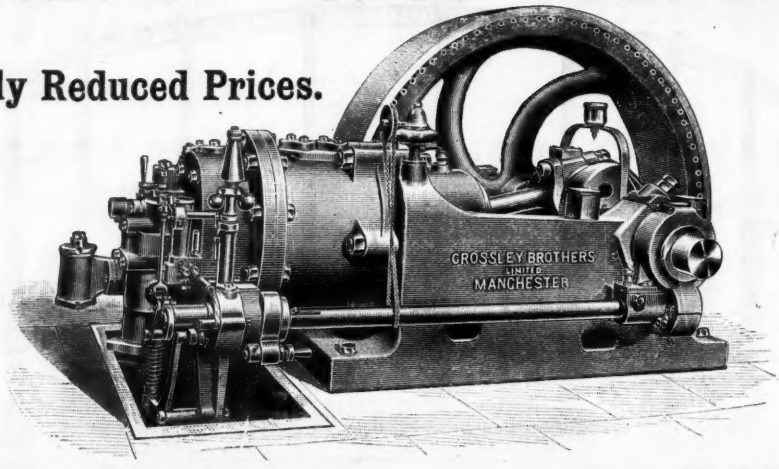

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Large Reduction in Prices From March 2, 1896, Due to Colossal Sales, And Universal Adoption of the System.

THE GREATLY REDUCED CONSUMPTION OF GAS
Covers the Initial Cost of the Burners in less than **SIX** Months.

The Prices have been REDUCED as follows:—

The Ordinary "C" Burner, price 6/6
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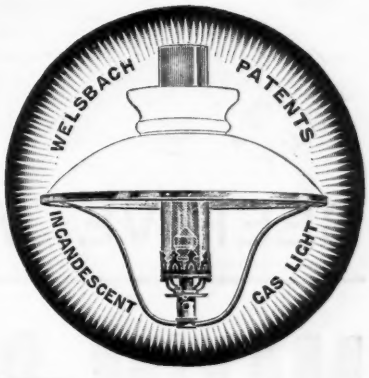
The "S" Bye-Pass Burner, price 7/6

which, with a consumption of 2¼ cubic feet of gas an hour, gives

A LIGHT OF 25 TO 30 CANDLE POWER.

This pattern is particularly recommended where it is desired to effect a large saving in gas rather than to effect a great increase in the light.



The attention of Gas Managers and Gas Engineers is called to this System of Lighting as one which tends to **Popularize the Use of Gas** as an Illuminant, owing to the following Advantages:—

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The combination of High Lighting Power with DURABILITY can only be obtained by The Welsbach System.

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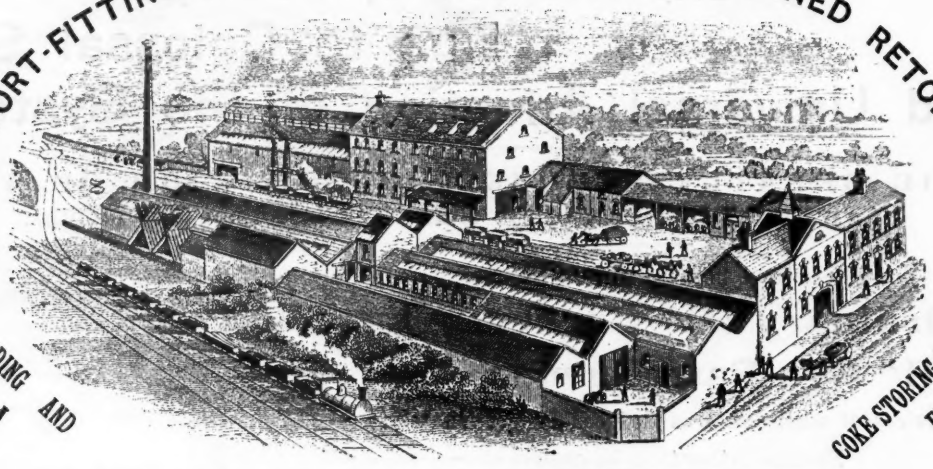

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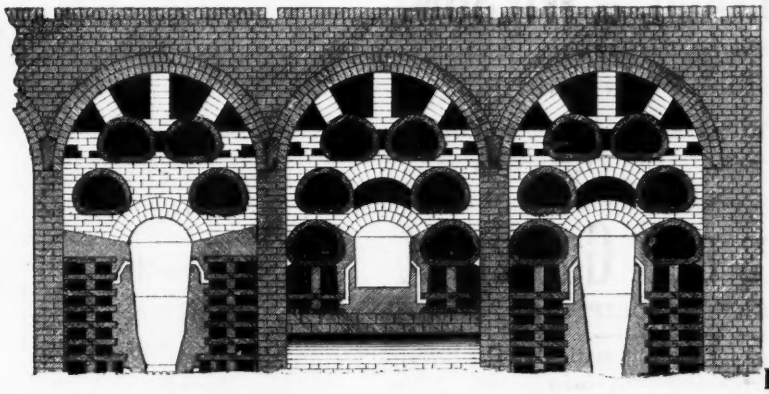

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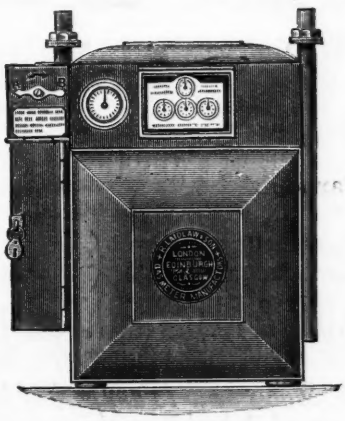

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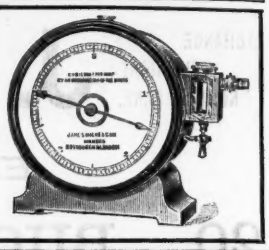

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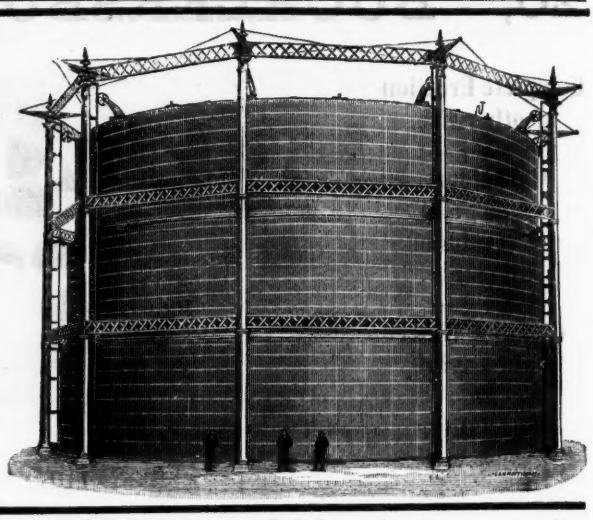

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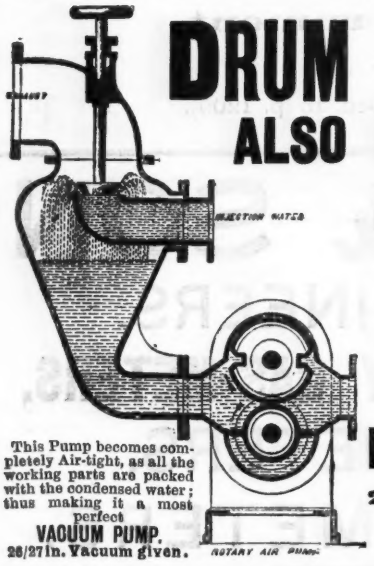

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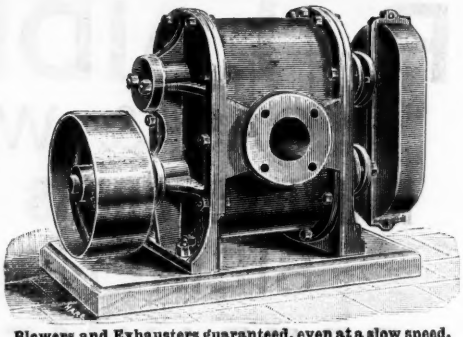

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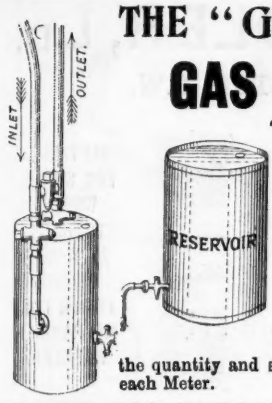

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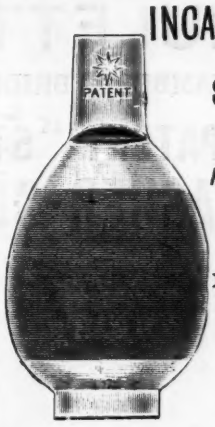

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No Chimney Required.

Prices 2s. 6d. to 4s. 0d.
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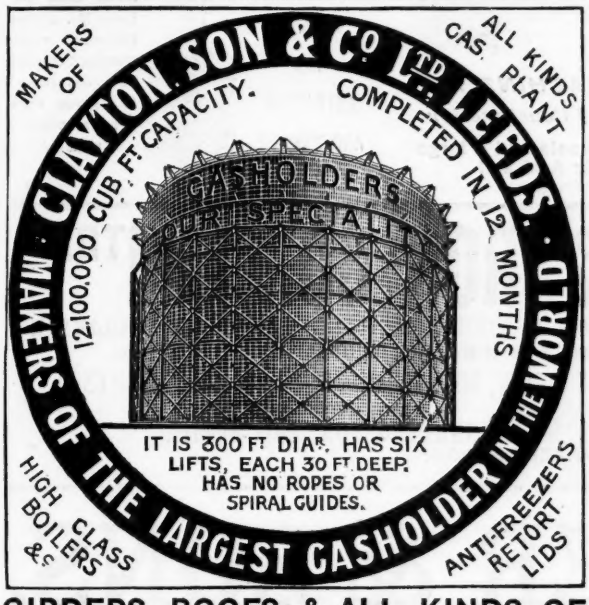
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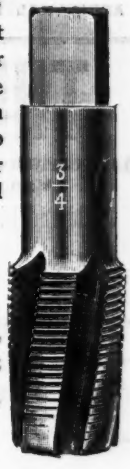

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RETORT BENCHES ERECTED COMPLETE WITH OR WITHOUT SPECIAL FURNACES.
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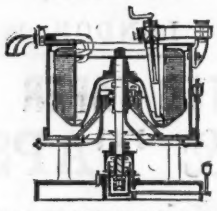

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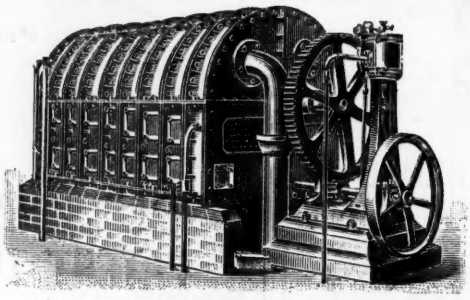

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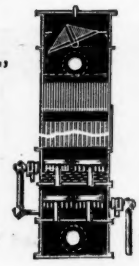

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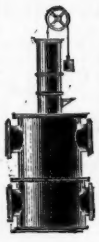

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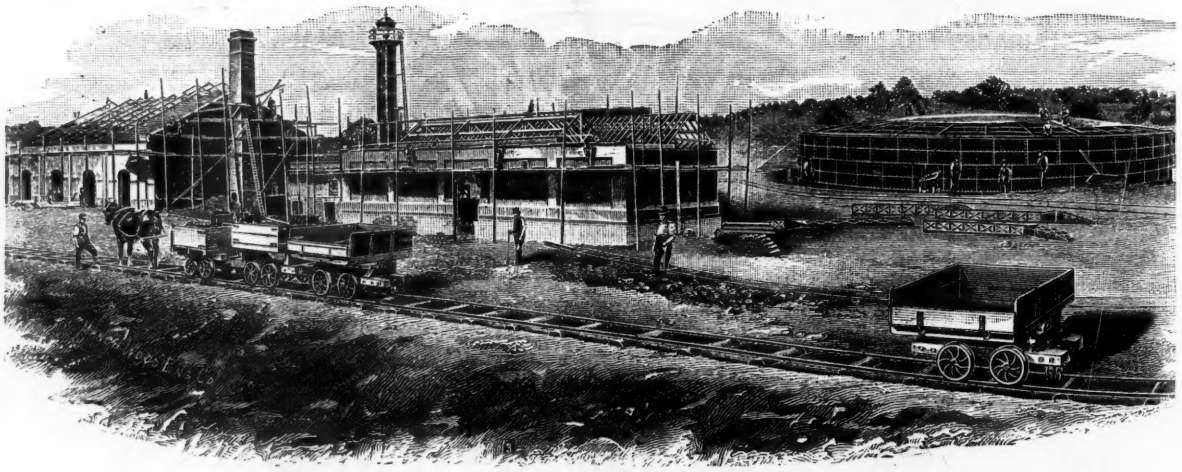

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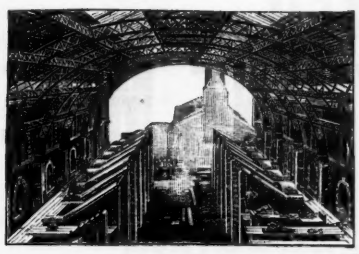

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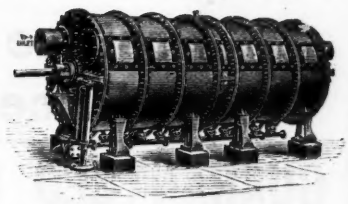

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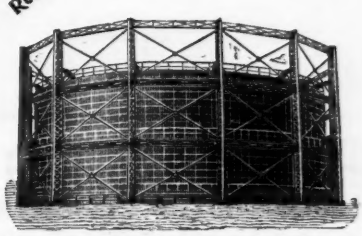

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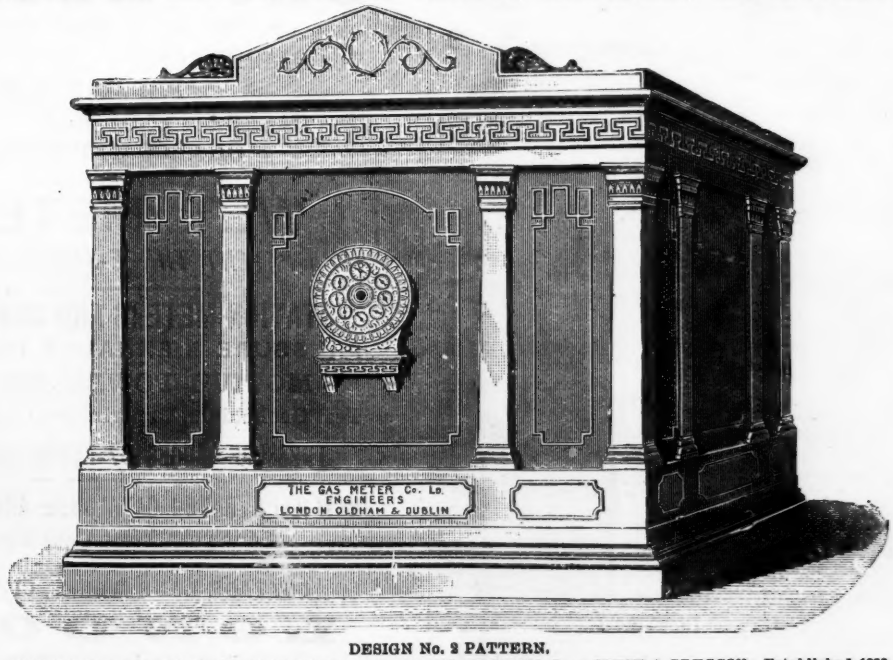

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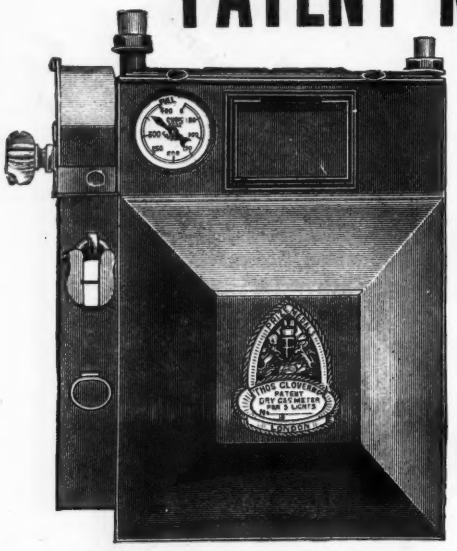

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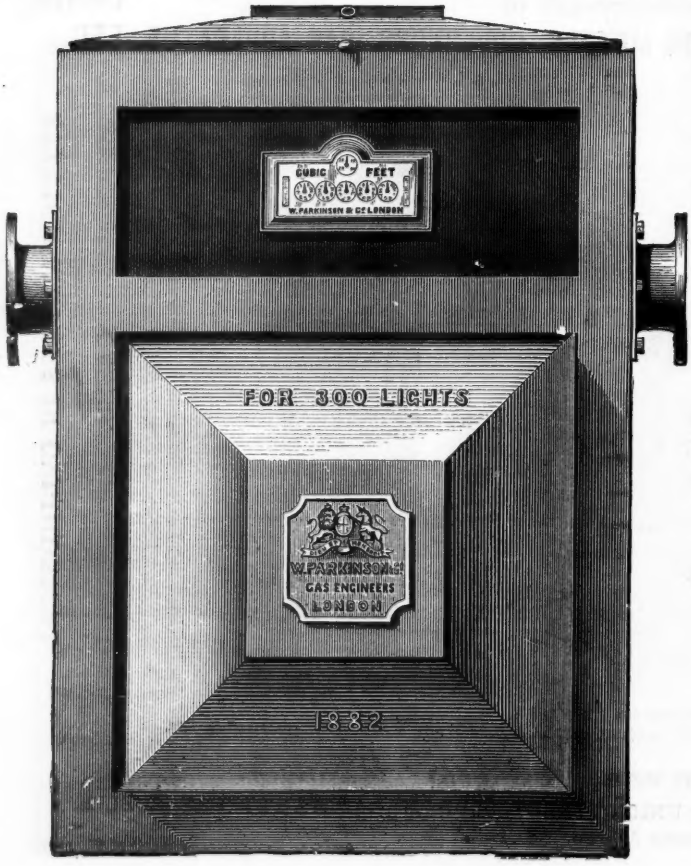

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EDITORIAL NOTES.

A Retrospect of the Year 1896.

THE year that is now drawing to its close may in the fulness of time be looked upon as a remarkable era in the world's history; but now, while its last days are passing over our heads, it does not appear to have been characterized by many extraordinary events of the kind that are usually chronicled in these columns. The trade of the country generally, and of the industrial world at large, has been good; and an unexpected rise in the value of wheat, if it did not have the effect of wholly removing the agricultural depression which has during so many years been the black spot in every survey of English trade, at least corrected many erroneous views that had prevailed as to the cause of so regrettable a state of things. During ordinary times, when the complicated machinery of modern finance, industrial production, exchange, and distribution works quietly, nobody knows to what cause to assign any local discrepancy with the general order of prosperous development of the material points of civilization. At such periods, the process of silent adaptation of facilities to potentialities goes on underneath the ordinary traffickings of civilized mankind; and insensibly the number of the world's markets is increased and their supplies augmented from new sources, as the result of cosmopolitan exploration and enterprise. So it happens that now and again the incessant readjustment of supplies to demands, which is the sum of innumerable independent experiments, is found to press hardly upon one or another old-established trade, while it is impossible to distinguish the source of the trouble. This is the opportunity for the promulgation of all kinds of financial and industrial quackeries, such as Bimetallism, Free Silverism, Trade Reciprocity, and so forth. People who are acutely suffering from depression of the value of their particular product, whatever it may be, are prone to give ear to anybody who professes to be in possession of a remedy for their complaint, and are apt to be impatient of the cold comfort offered by those political economists who would persuade them that all must be for the best so long as the majority of the community at large enjoy the benefit of cheapened commodities. Occasionally, however, something transpires to clear the air, and show the least observant of mortals that the immemorial laws of trade yet underlie all those complex agencies by which they work. Such an occurrence is the shortness of the wheat supply; and another is the demonstration of the people of the United States, through their choice of a new President, in favour of the principle of honest money.

Every general matter of this kind has innumerable reflections from particular interests; and the gas industry is not unaffected by the influences which we have been discussing. Financial uncertainties have led to the appreciation of sound investments; and accordingly it has come about that the value of gas stocks and British municipal loan issues exhibited a considerable increase during the year. The Gaslight and Coke Company's "A" Ordinary Stock stood at the beginning of the year at 295—300, and at Midsummer was quoted 314—319. It is now marked 317—322, at which price it yields the purchaser less than 4 per cent. at the last rate of dividend paid. Other gas stocks show an even greater appreciation. South Metropolitan "C" Stock began the year at 325—330, rising by Midsummer to 337—342; and the consolidated 4 per cent. stock, which represents this and the other stocks of the Company, is now quoted 145—149, at which price the investor receives less than 3½ per cent. for his money. This remarkable appreciation of gas stock is due to the combined influences of the need of capital for safe employment, and the deepening conviction of capitalists that this class of securities is deserving of confidence. The point has been more than reached, however, at which competent judges in such matters would fain draw the line. After all, gas stocks represent capital sunk in an industrial and commercial enterprise which cannot be regarded as exempt from all the risks of trade; and there is no reason in the nature of things why such capital should rank with funds absolutely secured directly and collaterally.

An important consequence of the enhanced value of gas stocks is the disappearance, in the case of all the most

important gas undertakings owned by Companies, of the old plea for municipalization based on the superior financial facilities enjoyed by Local Authorities as compared with Companies. This has long been understood in regard to the London Gas Companies, who can borrow money for something like 2¾ per cent., and whose future expansion will be in the main provided for by this means. A definite proof to the same effect was supplied during the year in a report upon the condition of the local gas supply received by the Corporation of Liverpool, which declared that the ratepayers would gain nothing by a transfer of the undertaking to the Corporation.

Concurrently with the improvement of its finances, the gas industry has illustrated its solidarity with the general trade of the country by making an exceptionally large increase in the output of gas, besides submitting to a diminished return from coke and sulphate of ammonia. The community have wanted much more gas for various purposes, notwithstanding the popularity of appliances for developing light from it at a great economy of consumption compared with anything known a few years ago. Coal has been cheaper; and though this has favoured the gas industry to the extent of an average of perhaps 6d. per ton on the cost of the raw material, as compared with last year's prices, the apparent advantage has often been lost in the depreciation of coke and sulphate of ammonia. Naturally, when coal becomes cheap, coke is apt to be a drug upon the market; and an unprosperous agricultural interest is not conducive to the absorption of a manure-stuff at high prices. Matters were, however, supposed to be aggravated in regard to the markets for coke and sulphate of ammonia by the mistaken policy adopted by the Directors of The Gaslight and Coke Company of accumulating stocks, which not only became more and more unsaleable as the year wore on, but also operated detrimentally to dealings in the same commodities all over the country.

A conspicuous feature of the British gas industry during the year was the astonishing growth in popularity of prepayment meters. The South Metropolitan Gas Company, who improved upon the experience of the Liverpool Gas Company—the real pioneers in this method of popularizing gas—had by the middle of the year 50,000 of these meters in use, and had spent £156,000 on them and on gas cooking-stoves in connection with them, besides £100,000 in fittings for small consumers' houses. The business of these meters assumed such importance, that the rumour of The Gaslight and Coke Company, who had followed the lead of the South Metropolitan, having decided to suspend the issue of these boons to poor householders was made the subject of a question in the House of Commons. The fact appeared to be that the Directors of the Company in question, having gone too lavishly into this branch of business, discovered that the limited capital powers of the undertaking were unequal to the pressure; and they were consequently constrained to reconsider the position. Prepayment meters were in great demand in other places besides London; but it became doubtful whether in some cases this requirement did not to some extent take the place of, instead of merely supplementing that for ordinary meters. It was likewise ascertained in general practice that the administration of the prepayment meter system entails the strictest attention to economy, and that even so a surcharge on the ordinary price of gas of at least 9d. or 10d. per 1000 cubic feet is required to cover the extraordinary expenses of the system—a charge which still leaves gas the cheapest light and fuel for cottagers' use.

The year was one of "alarms and excursions" in what is commonly called "the City." Speculation was rife from the very commencement of the year to its close; a vast number of joint-stock companies having been successfully floated, while many more perished untimely in the process. Some new ventures more or less connected with the gas industry came into existence, with the object of making and dealing in prepayment gas-meters, gas-globes, and improved gas-burners of various descriptions. Much financial and technical interest centred in the costly litigation by which the Incandescent Gas-Light Company succeeded in establishing the validity of Dr. Carl Auer von Welsbach's original patent of 1885 as the "master "patent" covering the manufacture of incandescent gas-burner "mantles" from the so-called rare earths. A great impetus was given during the year to the use of these burners for private and public lighting. Indeed, the year 1896 may be styled the era of the triumph of the Welsbach invention all along the line. Many attempts to contest the supremacy of this burner were quenched. The Wenham gas-lamp was revived, and received some patronage. The "Holophane" light-diffusing globes were put upon the market. An audacious attempt to impose upon the public in the matter of mechanical road-carriage traction by the flotation of a Company, with a huge capital, to take over "master patents" for oil-engines that had no existence, happily failed. The application of gas power to tramway traction by the Lührig system was put to an extended trial at Blackpool, after an experimental test at Croydon.

The general legislation of the year was scanty, and very little of it touched the gas industry even indirectly. A Government Act was passed for the strengthening of the hands of the President of the Board of Trade in dealing with industrial disputes by mediation. That parliamentary evergreen—the reform of legislative methods—appeared again; but nothing was done in the matter. An important parliamentary inquiry was held to determine whether anything further could be done to define the nature and extent of the "private interest" of members of Parliament in schemes of legislation which, according to existing rules, debars them from taking any part in divisions upon such questions; but it was decided that it would be better to leave the rule as it stands. A good deal of interest was aroused in the similar question as concerning the voting of members of local authorities, which is regulated by statute. The special gas legislation was of very considerable importance. The South Metropolitan Gas Company obtained an Act consolidating their capital upon the uniform basis of a 4 per cent. stock, and authorizing the appointment of employee Directors upon the Board of the Company. Much controversy had raged over and round the latter proposition; and when Parliament at length sanctioned it, the qualification was made so high as to render the provision nugatory. The Company have given notice of their intention to apply next session for an amendment of this enactment in the sense of the original scheme. The Cheltenham Gas Company obtained a new Act, by which their capital was consolidated upon a 5 per cent. basis; and the same advantage was obtained by the Guildford Company. The Leamington Corporation Act authorized the acquisition by the town of the local Gas Company's undertaking; and transfer Acts were likewise obtained for Matlock Bath and Ystrad. A unifying Act was granted to Edinburgh. An ill-considered attack on the Alliance and Dublin Consumers' Gas Company in a Bill of the Corporation was repelled by Parliament without calling upon the advocates for the Company.

Consequent upon statutory powers having been granted for the purpose, arbitrations were held for the valuation upon transfer of the gas undertakings at Chesterfield, Dunfermline, and Matlock Bath, with results that have been fully reported, so far as they are completed, in the columns of the "JOURNAL." That old "bone of contention" among surveyors and valuers, the addition of 10 per cent. for compulsory purchase, was the subject of a parliamentary debate during the past session, when a determined attempt was made to formally abolish the custom, but without result. The Driffield undertaking was transferred to the District Council upon a private valuation.

There was more than the usual litigation in regard to gas matters. The heaviest lawsuits were those already mentioned, over the Welsbach patents. A somewhat remarkable case was that of the appeal in *Clegg, Parkinson, and Co. v. The Earby and Thornton Gas Company*, which raised the question as to whether individual consumers have a right to sue Gas Companies for damages for a bad supply. The point was given in favour of the Company, on the general ground that the remedy for breach of the provisions of an Act of Parliament must be such as the Act itself provides, and no other. Incidentally, it transpired that there is no legal obligation upon Gas Companies to supply gas at all. The question of negligence in the case of a leaky gas-main was once more fought out in *Payne v. The South Metropolitan Gas Company*, when it was held that where Gas Companies carry on their business as prudent men would do, they are not liable for the results of unforeseen accidents. County Court cases at Cambridge and Godalming were decided on the same rule. A noteworthy decision upon a related point was given in the important case of *Hardaker v. The Idle District Council and Thornton*.

A question as to the interpretation of the Act of Parliament prescribing the test burner for Southport gas was raised before the local Magistrates, and carried on appeal to the Queen's Bench Division. Prosecutions for robbery of money from prepayment meters were somewhat numerous. As touching upon an evil which was at one time rife in the gas industry, it should be recorded that the prevalence in some branches of commerce of the illicit commission system was brought under the notice of Her Majesty's Judges, and evoked strong animadversion from the Lord Chief Justice.

The year was memorable for several scientific discoveries, and the active development of some important new materials and processes in the arts. Early in January, the world was startled by the announcement that Professor Röntgen, of the University of Würzburg, had discovered a form of radiant energy which was capable of penetrating many forms of matter impervious to light, and of enabling the bones of living animals to be photographed. With such rapidity does news circulate nowadays, and so familiar have people become, through the agency of innumerable demonstrators, with the phenomena related to the operation of the Röntgen rays, that it is difficult to realize the fact that only a twelvemonth ago the idea had not dawned upon mankind. The production of acetylene from calcic carbide, and the adaptation of various presumed improvements to the Welsbach gas-light, almost monopolized the attention of inventors of gas appliances. The production of cyanide as a bye-product of gas-works was exemplified on a large scale by Mr. W. Foulis, at Glasgow. The system of inclined retorts made continued progress in English gas-works; the first gas manufacturing station to be equipped throughout with this variety of carbonizing plant—Brentford—having completed the remodelling process. Mechanical stoking for horizontal retorts, and the adaptation of labour-saving appliances to carbonizing work, made considerable headway during the year; and the same may be said of the movement for reducing and abolishing the standing guide-framing of gasholders. The adoption of carburetted water-gas plant by British gas undertakings received additional impetus from the difficulty of obtaining a good figure for the coke production of large works, though the price of cannel fell to a point that removed one of the chief inducements felt by gas managers during recent years to use liquid carburetting material. Some notice was taken in gas engineering circles of the progress of the coke industry, which has of late years been greatly developed along lines that converge towards ordinary gas-works practice. A scheme was mooted in Massachusetts for the distribution of coke-oven gas for lighting and heating purposes. The growing popularity of the incandescent gas-light tended to direct attention to the superior advantages for the community of cheap as compared with highly carburetted, and consequently expensive, gas. The gas-producer was further improved by Dr. Ludwig Mond, who also distinguished himself by presenting to the nation a fully equipped and endowed research laboratory. Mr. Charles E. Botley, of Hastings, introduced a novel method of preventing naphthalene deposits in gas-mains. The subject of the photometric standard of light received further study by Mr. Dibdin, Mr. Methven, M. Violle—who proposed the use of an acetylene flame as a standard—and others; but the candle still retains its pride of place. Good work was done in relation to the detection of poisonous and explosive gaseous mixtures by Dr. Haldane and Professor Frank Clowes. The removal of the legal restrictions upon the use of mechanically driven vehicles on common roads, which dates from Nov. 14, led to several attempts to adapt oil-gas, and in one case coal-gas, motors to road traction.

The cause of "Labour" has been much in evidence, in gas-works and elsewhere, during the year. The organizers and officials of Trade Unions have taken advantage of the revival of trade to assert themselves and their organizations at the expense of employers; but the persistent dulness in the coal-mining industry has prevented the miners' societies from doing much in the way of striking. Lord Rosebery's celebrated "settlement," and the Conciliation Board which was the one obvious fruit of the last strike in the districts subject to the Miners' Federation, went "by the board" at the termination of the covenanted period, in August, without anybody appearing to miss them. Much futile negotiation took place in South Wales over suggestions for forcibly improving the state of the trade; but it came to nothing. The local branches of the Amalgamated Society of Engineers early in the year made trouble of a serious character on the Clyde and in Belfast, which had little other effect than to expose the financial weakness of the Society, and cause the employers to form themselves into a strong league for mutual protection. Boundary disputes between skilled mechanics belonging to the different trade societies which patronize the engineering and shipbuilding industries caused very grave inconvenience in several centres. Men employed in the building trades struck frequently, according to their custom. But legal action taken by a leading building firm succeeded in restraining the tyrannical conduct of the Union in a particular instance; and the Magistrates sent several pickets to prison for misconduct in this capacity. A strike of dock labourers occurred at Hamburg, encouraged by English agitators; and a threatened dislocation of the railway service at Christmas was only averted by prompt action on the part of the Companies and the Board of Trade. Notwithstanding the feverish anxiety of some of the professional leaders of the unions of unskilled labourers to assert the importance of these organizations, the Board of Trade statistics recently issued show that their membership and resources continue to decline.

Casualties in connection with the manufacture and use of gas occurred during the year in different localities; but, with the exception of a sad purifier accident at the North Shields works of the Tynemouth Gas Company, when five men perished from sulphuretted gas poisoning, they were not on a large scale. The predilection of persons of an inventive turn for meddling with the as yet but imperfectly understood calcic carbide resulted in two violent explosions of acetylene, in Paris and Berlin respectively, both attended with loss of life. The common deadly oil-lamp, as usual, was responsible for more deaths in London alone than could be ascribed to gas in all parts of the world. A Parliamentary Committee sat to take evidence as to whether these catastrophes in relation to oil lighting are caused by the lamp or the oil; but the inquiry has not been concluded.

The various technical societies connected with the British gas industry had, on the whole, a highly successful year. The Gas Institute met in London under the presidency of Mr. W. R. Chester, of Nottingham. Mr. Joseph Hepworth was succeeded in the honorary secretaryship of the Institute by Mr. A. Dougall, of Tunbridge Wells; and the place of the Secretary, Mr. F. G. Burfield, who also resigned, was filled by the appointment of Mr. Walter T. Dunn. The Institution of Gas Engineers met twice—in London in May, and again in Glasgow in September—under the presidency of Mr. W. Foulis. The District Associations of Gas Managers fulfilled their purpose; two of them—the Southern and the South-Western—finding it expedient to unite their forces. There is thus one District Association the fewer as compared with last year.

The obituary list of the year is long, and contains some eminent names. Mr. Leonard George Drory, one of the Chief Engineers of the Imperial Continental Gas Association, Mr. John M'Crae, of Dundee, Mr. Thomas Travers, of Cork, Mr. Jabez Church, and very recently Mr. F. T. C. Linton, of Edinburgh, were all men of mark in their chosen profession. Sir Julian Goldsmid, Sir Henry Calcraft, Mr. William Wake, of Sheffield, Sir George Morrison, Mr. G. P. Bidder, Q.C., Mr. D. Kinnear Clark, and Mr. Joseph R. Thomas, of New York, also served the gas industry in diverse ways. Death and other causes have made some changes in the personality of the industry, all of which were recorded in the "JOURNAL" at the proper time. And now nothing more remains to be noted of the year that is so nearly "awa'" besides registering the fact that in it the gas industry throve and flourished exceedingly, and is actually filling a greater space in the workaday world than it has ever occupied before, and facing a larger future with confidence and hope.

The Lubrication of Wire Ropes.—For the lubrication of wire ropes, the use of a mixture of mica, axle grease, tar, and summer oil is recommended. According to the "Engineering and Mining Journal," this is unpatented, and can be made of any desired consistency. The tar and oil must be free from acid. It is claimed that it thoroughly penetrates between the wires, prevents rust, and fills the cable, resists water, does not strip, and is very economical if added sparingly, as all lubricants should be, after the first dose.

WATER AND SANITARY AFFAIRS.

The Principal Events of the Year 1896.

As affecting a population rapidly approaching six millions, the London Water Supply naturally forms a prominent subject, claiming the attention of the Government as well as of the Local Authorities. The commencement of the year found this question in a singularly unsettled state. The eight Transfer Bills which the County Council had brought into Parliament in the early part of 1895 were in a dubious condition, which was very properly described as one of "suspended animation." Whether the Bills were dead or alive appeared uncertain; and the County Council were evidently perplexed as to the next step to be taken. In their extremity, they sought, by direct communication with the Marquis of Salisbury, to ascertain whether the Government would promote or assist legislation dealing with the Metropolitan Water Question in such a way as to give the entire control of the supply within the area of the Administrative County into the hands of the Council in conjunction with the City Corporation; leaving the supply of the outer areas to the control of the Local Authorities in those districts. To this Lord Salisbury discreetly replied that Her Majesty's Government were not prepared to express an opinion with respect to any projected legislation upon the subject until the Bill containing the provisions by which such a project was to be carried into effect had been presented to Parliament. While the Council were at a loss as to their actual position, the Water Companies were taking action in a businesslike way. Three of the Companies had combined to give notice of a scheme for the construction of a great system of storage reservoirs at Staines. In addition, the New River Company and the Southwark and Vauxhall Company were going to introduce Bills authorizing extensive additions to their works. The Companies were declared to be "stealing a march upon the "Council"—the latter being left without an alternative proposition for the consideration of Parliament. All the Council had hope of doing was to oppose the Bills of the Water Companies, and to indicate the superior character of their scheme for bringing a supply of water from Wales. In the end, hope revived, and the Council found themselves in a position to proceed with their eight Transfer Bills.

Immediately before the assembling of Parliament, the report of Colonel Ducat and Dr. Barry—two departmental Inspectors of the Local Government Board—made its appearance, showing the result of their inquiry respecting the alleged failure of the East London water supply during the summer of 1895. The Inspectors attributed the deficiency to the extreme drought, following on a severe frost which had caused such extensive fractures in lead pipes that they could not be repaired fast enough to prevent exceptional waste. Perhaps a yet more important conclusion was that which declared that the Company had been placed at a disadvantage by the want of the additional storage and pumping power which their Bill of 1893 would have given them, had it passed into law at the time. Of course, all this was very unacceptable to the County Council, who were shown to have led Parliament astray in 1893, and on whom rested the responsibility of attempting the same thing in 1894. Such a record did not improve the position of the Council in Parliament, either when pushing their Transfer Bills or when opposing the extension Bills of the Water Companies. In February, there was a surprise for all parties, when the Queen's Speech announced that a measure had been prepared "for amending the law "with respect to the supply of water to the Metropolis." Yet the County Council had themselves invoked the thunder, by a resolution, passed only three weeks before, approving the principle of entrusting the water supply to a public authority, but leaving it to Parliament to settle what the authority should be. They had their answer in the promised Bill. But they nevertheless resolved to go on with their Transfer Bills, inconsistent as such a course might appear, especially as they had professedly left the question open as to the authority that should possess the supply. In the middle of March, the Government measure, under the name of the Metropolitan Counties Water Board Bill, was introduced into the House of Lords by Lord James of Hereford. The project was that of creating a Board having jurisdiction over the entire area of the Metropolitan Water Supply. This new authority was to be composed of representatives from various bodies, including the Corporation, but with a direct, though slight, majority for the London County Council, in the shape of sixteen members out of a total of thirty. The Corporation were allotted two members—that is to say, one-eighth of the number granted to the County Council. The introduction of the Government Bill had the effect of inducing the Council to adjourn the consideration of their scheme for bringing a supply from Wales; but they refused to let their Transfer Bills suffer delay. March 24 proved an eventful day in Parliament with respect to the Water Question. After a debate occupying nearly three hours, the House of Commons negatived the motion for the second reading of the Transfer Bill relating to the undertaking of the Chelsea Water Company; the majority being 287 against 125. There was thus a decisive rejection of the transfer scheme; and the disposal of the remainder of the Bills relating to it followed necessarily. The second reading of the Kent Water Board Bill, designed to separate from the Metropolis the outer portions of the districts of the Kent and Lambeth Companies, was negatived without a division. The Staines Reservoirs Bill, the New River Company's Bill, and the Bill of the Southwark and Vauxhall Company were read a second time, and referred to a Select Committee of nine members. The Water Bills of the Chelsea and Lambeth Companies, suspended from the previous session, were referred to the same Committee. A clean sweep was made of nine Bills representative of Progressive views. The magnitude of the question is shown by the circumstance that Parliament had before it in the course of the past session as many as fifteen Bills relating to the water supply of the Metropolis. In addition to the foregoing, there was one promoted by the London County Council, proposing an increase in the height of supply in the East London district. This was first of all postponed, and subsequently withdrawn.

The fate of the Transfer Bills might have been different but for the determination of the Progressive party to enforce unreasonable terms in the arbitration clause respecting the purchase of the water undertakings. Negotiations were conducted between Mr. Stuart, as representing the County Council, and the President of the Local Government Board. Mr. Chaplin desired the Council to rely upon the ordinary law. But to this Mr. Stuart would not consent. All the Transfer Bills were consequently opposed by the Government, and came to naught. The blow was keenly felt by the Progressive party, and they professed to marvel at the ill success which attended their efforts to "municipalize the water supply"—a principle which they considered had been approved by every Committee and Commission which had gone into the question. The only remaining hope of the Progressives was to kill the Government Bill, the passing of which, they considered, would block their way for ever. The irreconcilable spirit of the Progressive party in dealing with the Water Question was shown by their sacrifice of the support which they might have gained from Mr. Chamberlain. This statesman would have held out a hand to them; but he declared the case was rendered hopeless if they would consent to no settlement which did not enable them, in dealing with the Water Companies, "to extort terms which had never been "asked for in any previous case by a municipal authority." At the meeting of the Council which immediately followed the overthrow of their Bills, the Earl of Onslow expressed a belief that, if Mr. Stuart had but consented to a postponement of the second reading, a way would have been found by which the existence of the Bills might have been prolonged, presumably to some useful purpose. Sir Arthur Arnold, the Chairman of the Council, declared his conviction that, if the Transfer Bills had not been so summarily disposed of, "a settlement by agreement "would not have been impossible." Sir Arthur, as authorized by the Council, had been negotiating with the Companies, and had been favourably impressed by the manner of his reception. As, however, the Bills were gone, Sir Arthur signified that his negotiations ceased. Another matter which went against the Council was the decision of the Local Government Board refusing to adopt the suggestion that three should be substituted for two gallons in the regulations prescribing the quantity of water to be used as the flush of a water-closet.

After an animated debate, the Metropolitan Counties Water Board Bill passed its second reading in the House

of Lords at the end of April, by a majority of 96 to 27. Hopeful as this result appeared, the measure made no progress in the House of Commons, and was simply dropped. The Earl of Rosebery, when attacking the Bill in the Upper House, declared that "nobody wanted it." Even the Government, he considered, did not want it. Probably they would have been very content to have left the matter alone; and it would seem that they were chiefly induced to move by the apparent demand that the water supply should be placed in the hands of a responsible public authority. They felt, according to the statements of Lord James, that the County Council would not be a suitable authority, though by the Bill they gave the Council a predominant share in the management. There was perhaps an unfortunate amendment brought forward by Lord James before the Bill went down to the Commons, which opened the way for a severance of the outer areas. This virtually provided for cutting off the outer fringe, and deprived the measure of much of its coherence. Tactically, the amendment had the advantage of conciliating most of the outer authorities, though it suffered loss to some extent in what might be called its statesmanlike features. But the new clauses were agreed to in the House of Lords; and the thus amended Bill went through Committee. It was read the third time and passed early in July. In the middle of that month, replying to a question in the House of Commons, Mr. Chaplin stated that, unless the Bill was absolutely uncontentious, it would be hopeless to attempt to pass it during that session. He did not propose, therefore, to proceed with the second reading. The Government, however, hoped to deal with the question in the next session of Parliament.

Sir Joseph Pease presided over the Hybrid Committee to whom was referred the five Bills promoted by the London Water Companies, including the two that were standing over. The Committee were subject to an Instruction that they were not to confer additional powers, except so far as these were proved to be necessary for the carrying out of works which could not be postponed without detriment to the interests of the public. Early in July, the Committee presented a special report, in which they stated that they had passed the preambles of the Bills promoted by the Chelsea, Lambeth, and New River Companies, as also the Staines Reservoirs Bill. They had made extensive alterations in clauses, and in the case of the Staines Bill had considerably amended the preamble. The preamble of the Southwark and Vauxhall Company's Bill they found was not proved. In the course of their report, the Committee discussed several most important matters connected with the main question of the water supply, and stated that it would be greatly to the public interest that both the Water Companies and the inhabitants of London should be speedily freed from the anomalous position in which they were placed in regard to the schemes which came before Parliament. In the case of the New River Company's Bill, it is to be feared that the project was cut down by the Committee to an extent which will be found prejudicial to the public interest rather than otherwise. The clipping of such measures is generally a perilous process. The Southwark and Vauxhall Bill was entirely lost, as proposing works capable of being postponed. Of course, the responsibility of delay rests with Parliament, though if the water supply should run short, the sufferers are not likely to take this into consideration, or at least the agitators will not.

The past summer was characterized by an extraordinary drought; and the East London Water Company, despite the most vigorous efforts to construct the works authorized by their Act of 1894, were placed under the necessity of reverting to an intermittent supply, instead of maintaining the constant service. Wherever house cisterns existed, the supply was still found to be ample. But the general want of these appliances led to severe inconvenience among the poorer class of inhabitants. A large amount of undeserved odium was cast upon the Company in connection with this unfortunate state of affairs. But the facts were well understood by Mr. Chaplin; and some admirable articles on the subject appeared in "The Times." In reply to a letter from Mr. Lionel Holland and ten other members of Parliament representing East London constituencies, an important announcement was made by the First Lord of the Treasury, which could only be interpreted as meaning that the Government would take steps in the coming session to bring the Metropolitan Water Question to a settlement. But the County Council have nevertheless decided on having a scheme of their own, and have deposited eight Bills for the purchase of the undertakings of the London Water Companies. The nature of these Bills has already been described in our columns. Some of the unjust provisions in the Transfer Bills are now omitted; but others remain, and there is to be no compensation for compulsory sale. In the preparation of this scheme of purchase, great efforts were made to engage the Moderates in a compromise with the Progressives; and to this we may perhaps attribute the modified nature of the project as compared with the Transfer Bills. But when the County Council had to decide finally on approving the Bills, the divisions ran very close; and the measures can only be said to have been carried at Spring Gardens by a majority of seven. How the Council can hope to gain the support of the Legislature for measures so feebly originated, it is difficult to conceive. Two of the Companies are also in the field, with projects well matured, and about which the Directors are fully agreed. The Bill of the New River Company asks for power to raise additional capital, in the form of debenture stock, to the extent of a million. The East London Company ask for half this amount. The works proposed by the New River Company's Bill are closely connected with the Staines reservoirs. The East London Bill includes the construction of new reservoirs, with aqueducts and other adjuncts. The Kent Water Board Bill appears again, and is understood to stand or fall with the Purchase Bills of the County Council. At one time, it was expected that the Council would promote a Bill in the ensuing session for carrying out that part of the Welsh scheme which relates to the watersheds of the Usk and Llangorse. But the Council allowed the measure to be stopped by their own Standing Orders.

The history of the year would be incomplete without some reference to the microbe "scare" which arose a short time back, in consequence of the publication by the County Council of sundry reports on the London Water Supply, detailing analytical investigations by their Chemist (Mr. W. J. Dibdin) and other experts, notably by Dr. Klein. Not only were microbes found in the water—as they may be found almost anywhere—but Mr. Dibdin discovered that a gallon of the London Water Supply contained the 500th part of a grain of suspended matter. But Dr. Klein was perfectly appalling in his account of the microbes, of which he detected above 48,000 in a cubic centimetre of the Lambeth water; and 51,000 in the like quantity of the Southwark and Vauxhall supply. A large amount of controversy has arisen upon the subject; but the result has been to reassure the public that there is nothing which need excite any misgiving in respect to the quality of the water, or any doubt as to the accuracy of the customary reports from Dr. E. Frankland, Professor Percy Frankland, Mr. Crookes, and Professor Dewar. There has been a "scare," such as might very well suit the tactics of the County Council, in seeking to oust the Companies and to introduce a water supply from somewhere in Wales at the cost of sundry millions.

The drought of last summer was felt in the Provinces as well as in London; the water supply being considerably restricted in some of the large towns. Streams in the Welsh hills which are to render a supply to Birmingham ran dry; the impermeable primary rocks having the effect of throwing off the rainfall, instead of retaining it for a time like a sponge. London is dependent for its supply upon absorbent strata, and hence enjoys the advantage of a natural reserve. The Metropolis, even in those parts especially affected by the recent drought, had a daily supply which would have abundantly satisfied many towns where the want of water was severely felt. Great scarcity was experienced at Leicester. At Devonport, the level of water in the leat which supplies the town was lower than it had been known to be at any time for many years. From various parts of England came similar statements. In South Wales, before the end of July, the water supply at Aberavon was practically exhausted; the quantity flowing in the main being only one-twentieth the usual consumption. Neath was considered well off with a supply turned on for at least an hour a day. In the Rhondda Valley, with a population of 130,000, water became very scarce. The necessity for considerable extension to the water-works of towns, so as to provide against protracted seasons of dry weather, is thus enforced, as in 1895. A new reservoir in the Langsett district, taking

four or five years for its construction, is to aid the supply of Sheffield. At Newcastle, an additional reservoir is in progress on the Rede, which when finished will bring up the storage capacity of the works to more than 5000 million gallons. At Huddersfield, the Corporation are adding to their reservoirs; the demand for water having been largely augmented, owing to the growth of the population and the immense increase in the consumption of water for trade purposes. The Barnsley Corporation, whose Water Bill passed the House of Lords last year, and afterwards remained suspended awaiting its second reading in the Commons, succeeded in getting their scheme through Parliament this year. The Act empowers the Corporation to obtain a supply of water from certain tributaries of the River Porter, or Little Don, and to construct an impounding reservoir. The sum of £170,000 is to be raised for the purposes of the Act, which amount is to include the recent cost of opposing the Water Bill of the Sheffield Corporation. Among the Water Acts obtained last session is one which authorizes the Commissioners of Kirkcaldy and Dysart to borrow £100,000. The Malvern Link Extension Act authorizes £50,000; the Eastbourne Company obtain power to raise £150,000 of new capital; and the East Surrey Company, £40,000. Of the projects for the coming year we have lately given an account. They are chiefly remarkable for works of extension, and for the somewhat numerous instances in which Local Authorities seek to purchase the undertakings which have been established by Companies. There is a project of some magnitude for supplying water to certain localities in the counties of Glamorgan, Monmouth, and Brecon. An interesting event connected with the past year, and one likely to lead to results of practical importance, consists in the formation of the British Association of Water-Works Engineers. The society held its first meeting in July, at Nottingham, under the presidency of Mr. D. M. F. Gaskin, M.Inst.C.E., Water Engineer of the Nottingham Corporation.

Strikes in Germany in 1895.—In the "JOURNAL" for Dec. 8, we gave, from a recently issued Blue-book, some account of the strikes and lock-outs which occurred in England in the year 1895. It may be of interest to supplement these particulars by some statistics furnished by the German Trades Commission in regard to the strikes in that country in the same period. On the whole, 204 strikes were reported, as compared with 131 in the previous year; 14,032 persons joining in the strikes, against 7328 in 1894. The strikes lasted 1030 weeks, as compared with 879 weeks; consuming 424,231 marks from the supporting funds, against 354,297 marks in the preceding twelve months. There were two sorts of strikes—offensive and defensive; the former being those where the men demanded higher wages and less work, while the latter were those where masters wished to reduce the wages and prolong the hours of work. The final results of 100 offensive strikes were as follows: In 57 cases, the men gained the victory; in 18, they had only a partial success; while in 25 instances they were defeated. As regards the defensive strikes, out of the 92 cases that are taken into consideration, the men in 30 cases were victorious; in 12, they had but a partial triumph; while in 50, they were beaten.

The Davy-Faraday Research Laboratory at the Royal Institution.—Our readers are aware that Dr. Ludwig Mond has presented to the Royal Institution a research laboratory, which he has named after Davy and Faraday. It is located in premises adjoining the Institution in Albemarle Street; and its generous donor has provided an ample endowment for its maintenance. It was formally opened last Tuesday by the Prince of Wales, in the presence of a large and distinguished audience. Dr. Mond explained that the laboratory had been erected in realization of a movement originally initiated some fifty years ago, under the auspices of the late Prince Consort, to provide a place where original researches could be carried on by a number of independent investigators in purely scientific chemistry as well as in physical chemistry. He believed it would stand favourable comparison with any other laboratory in or out of England in respect to the completeness of its equipment. It was unique of its kind; being the only public laboratory in the world solely devoted to research in pure science. Lord Rayleigh and Professor Dewar had consented to undertake without emolument the duties of Directors. The Prince of Wales congratulated the members of the Royal Institution on this most important accession to its resources, which they owed to Dr. Mond's generosity. His Royal Highness then declared the laboratory open; and Professor Dewar subsequently performed a number of experiments illustrative of the use of liquid air in scientific research. We may add that, while the laboratory owes its existence to Dr. Ludwig Mond, his son (Mr. Robert L. Mond) is responsible for the arrangement and equipment of the building, the cost of which has been approximately £32,000.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1300.)

SHORT as last week was, it was quite long enough for all the business that there was to be done. Things could not possibly be much quieter; and for lack of work, the spirit of playfulness ruled the House supreme. Perhaps this tended to save the position of some prices which might otherwise have been attacked; for certainly almost everything held on pretty strong, instead of drooping for lack of support. The bank failures in America affected that distressful market; but even it showed a bit of a rally before the close. The Money Market was very firm; and it really seemed as if the 4 per cent. rate had come to stay. But in these ticklish times, something may turn up any moment to upset one's expectations. Business in the Gas Market was fully up to what could be looked for in Christmas week. The general characteristics were much the same as those of the preceding week. The big issues had it nearly all to themselves; and their individual tendencies remained unchanged. Gaslight "A" was brisk and active, and pushed its quotation up a couple of points more—changing hands every day at a steady mark of 320. The secured issues were hardly noticed; only one deal in the 7 per cent. maximum being recorded. South Metropolitan was quiet, steady, and unchanged. Nothing at all was done in Commercials, which have recently been largely bought in a strong quarter, and are now lying quiet. In the Suburban and Provincial division, not a single line was marked. Brighton and Hove original was put up 8. The only thing remarkable about this is that it was not done earlier; for it must have been pretty widely known that considerably higher than the quoted figures could be had for the stock by any who chose to ask them. Scarcely anything was done among the Continental group, except in Imperial. It opened about a couple of points weaker—at 212—which remained about the standard for the week, though it had slight fluctuations in favour of a little firmer figure. The quotation closed 3 down. We believe the situation in Vienna has not undergone further development. Other undertakings offered no feature calling for remark. The Water Companies were in a state of absolute stagnation; and, with the exception of some little buying of Chelsea preference at choice figures on Monday, not a single transaction was marked in any one of them.

The daily operations were: Business in Gas was fairly active on the opening day, considering the season. Gaslight "A" were strong, and advanced 1. Brighton and Hove original moved up 3. Transactions were less extensive on Tuesday. Gaslight "A" again improved its position, and gained 1 more. Imperial Continental showed some weakness, and relapsed 1. Wednesday was a little quieter still as the holidays got closer. Gaslight "A" was very firm, but unchanged. Imperial looked a little weaker; but the quotation was left standing. Thursday, the finishing day, was a bit more active. Imperial fell 2; and one deal was done special at 211. Brighton and Hove original rose 5. Gaslight "A" was unchanged.

THE GAS UNDERTAKINGS RETURNS.

As mentioned in our editorial columns last week, the returns relating to the gas undertakings of the United Kingdom for the year ending Dec. 31, 1895, in the case of the Companies, and March 25, 1896, for the Local Authorities—were issued on the 21st inst., pursuant to an order of the House of Commons dated the 11th of August. This is a slight improvement upon last year, when both the order and the publication were a few weeks later. We give below the principal figures.

The returns furnish particulars in regard to 429 authorized gas undertakings in the hands of Companies—being one more than in the preceding return. Two of the Companies are in Scotland and nine in Ireland. The returns include statistics relating to four Companies who have not hitherto been in the list—viz., those at Felixstowe, Hayward's Heath, Llanberis, and Newmarket. On the other hand, Accrington, Hebden Bridge, and Rastrick have dropped out—the two former places now appearing in the returns from Local Authorities. These consist of particulars respecting 203 undertakings, as compared with 199 last year. The new comers are Accrington, Hebden Bridge, St. Ives (Cornwall), and St. Mary Church. Of the total, 36 are in Scotland, and 6 in Ireland. The amount of capital authorized for the 632 gas undertakings is £84,410,867, of which £70,819,742 has been paid up and borrowed. The previous amounts were £83,651,983 and £69,423,431. The receipts on revenue account are £19,461,147, as compared with £19,408,265; and the expenditure is £14,373,288, against £13,791,520. Turning now to the statistics of working, the quantity of coal and cannel carbonized in the period covered by the returns was 11,937,446 tons; the bulk of gas produced being 121,421,752,691 cubic feet, of which 111,443,701,941 cubic feet were sold. The previous totals were: Coals, 11,319,301 tons; gas made, 114,295,640 cubic feet; gas sold, 105,160,990,259 cubic feet. At the dates to which the last

returns were made up, there were 23,857 miles of mains in use for the supply of 2,659,771 consumers and 526,888 public lamps. The previous figures were: Miles of mains, 23,310; consumers, 2,524,217; public lamps, 512,856. The returns, as a rule, are made up to the dates named above; but where other periods have been taken, the fact is indicated. In the case of Accrington, for example, the return is for fifteen months. In a few instances, precise information cannot be given as to the make of gas, the consumption for public lighting, and the length of mains; but mostly the particulars required by Parliament are furnished. The amount of capital authorized for gas undertakings in the hands of both Companies and Local Authorities includes, in some instances, other purposes.

Comparing the foregoing figures with similar returns for the previous nine years, it will be seen that the capital obligations of the Companies are as follows:—

Year.	Share and Premium Capital Paid up.	Loan Capital Issued.	Capital Sold under Auction Clauses.	Premiums Realized.
1886. . .	£30,960,026	£5,679,830	£3,209,564	£1,393,773
1887. . .	31,556,788	5,839,792	3,354,093	1,473,656
1888. . .	31,736,024	6,002,510	3,488,588	1,517,902
1889. . .	32,117,202	6,090,546	3,641,730	1,563,595
1890. . .	32,884,026	6,568,676	4,008,465	1,765,557
1891. . .	34,282,164½	6,862,117	4,300,266	1,823,068
1892. . .	35,266,898½	7,149,367	4,755,597	2,144,619
1893. . .	36,491,562½	7,544,563	5,417,667	2,432,970
1894. . .	37,059,199½	7,739,678	5,715,024	2,637,019
1895. . .	37,307,330½	7,888,086	5,974,455	2,779,604

Some of the other comparative details in the Companies' returns are—

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1886. . .	5,777,966	59,051,111,814	1,133,897	258,072
1887. . .	5,977,254	61,266,055,857	1,152,119	264,316
1888. . .	6,050,588	62,328,542,470	1,103,198	259,921
1889. . .	6,309,495	64,627,914,489	1,128,838	268,013
1890. . .	6,618,460	67,214,546,500	1,153,989	275,611
1891. . .	7,071,161	70,953,927,023	1,180,333	282,761
1892. . .	7,119,189	72,178,028,396	1,213,322	288,021
1893. . .	6,995,125	71,050,955,154	1,225,253	296,910
1894. . .	7,128,126	72,610,842,498	1,266,943	295,787
1895. . .	7,531,131	77,245,618,489	1,339,712	302,015

The somewhat similar figures for the Local Authorities are—

Year.	Amount Borrowed, including Annuities (not deducting Repayments).	Receipts.	Expenditure (exclusive of Amount in the next Column).	Interest, &c., Paid.*	Net Profit after Payment of Items in preceding Column.
1886-7 .	£19,723,046	£4,403,262	£3,127,047	£951,636	£359,532
1887-8 .	20,081,435	4,495,093	3,161,604	923,157	439,467
1888-9 .	21,333,833	4,817,269	3,375,197	977,154	479,489
1889-90.	21,669,789	5,067,843	3,627,578	971,755	486,483
1890-91.	21,891,655	5,628,212	4,231,643	956,183	460,608
1891-92.	22,476,180	5,906,319	4,589,109	965,533	397,947
1892-93.	22,734,556	5,983,359	4,702,179	994,517	305,040
1893-94.	23,619,082	6,219,460	4,866,486	1,038,462	341,470
1894-95.	24,624,554	6,402,046	4,681,035	1,114,014	622,366
1895-96.	25,624,326	6,478,191	4,881,944	1,126,170	493,886

* These figures include: (1) Interest paid on loans; (2) amount paid for annuities; (3) amount of loans repaid; (4) amount paid for redemption of annuities; (5) amount placed to sinking fund.

Year.	Tons of Coal Carbonized.	Cubic Feet of Gas Made.	Number of Consumers.	Public Lamps Lighted.
1886-7 . .	2,879,765	28,880,425,240	996,480	155,849
1887-8 . .	2,985,577	30,105,457,962	1,011,139	159,264
1888-9 . .	3,204,982	32,381,124,770	1,089,748	174,191
1889-90. .	3,353,516	33,453,368,830	1,115,267	178,867
1890-91. .	3,623,967	35,796,491,799	1,143,289	184,773
1891-92. .	4,148,131	37,740,332,448	1,172,704	192,323
1892-93. .	3,977,291	39,303,250,095	1,203,574	201,484
1893-94. .	4,025,167	39,730,833,247	1,226,332	210,316
1894-95. .	4,191,175	41,684,838,142	1,257,274	217,069
1895-96. .	4,406,315	44,176,134,202	1,320,059	224,873

Fuel Gas Supply at Bridgeport (Conn.).—According to reports lately to hand from Bridgeport (Conn.), the Citizens' Gas Company have fairly established in that town a supply of fuel gas made by Loomis plant. The Company furnish all the necessary appliances, such as ranges, &c., at manufacturers' prices; relying for their profit solely on the gas used. They are now supplying about 300 homes; and several large factories have been connected with the plant. The price charged is 50c. per 1000 cubic feet, with liberal discount according to the quantity used. Nearly all the cafés in the centre of the town use fuel gas in place of coal or gasoline. At one of the best known of these establishments—the Amazon—it is employed for every purpose. In the kitchen, it is used in place of coal; in the cellar, an engine operated by it develops the electricity used for lighting; and, in addition, it works the boiler, which generates heat for keeping the building warm.

ELECTRIC LIGHTING IN 1896.

THE faithful chronicler, when called upon to give a succinct account of the course of the electric lighting industry of the United Kingdom during the past year, must be conscious of having a somewhat delicate, not to say invidious, task set before him. Has the much-vaunted "light of the future" become the light of the present? Have the electricians succeeded in taking away the occupation of gas managers, and given the *quietus* to an old-fashioned industry which they have rated as moribund these many years past? If we were compelled to value the electric lighting industry by these pretensions of some of its partisans, the result would be a declaration that during the past year this industry has not made the smallest advance towards the realization of the ideal future sketched out for it. There is more gas than ever burnt every night in the United Kingdom; and consequently, if the ruin of the gas industry is to be the necessary concomitant of the triumph of electricity, then the latter must by the same token be regarded as indefinitely deferred. There is another way of looking at the subject, however; and it is one which we prefer to take, when our friends the electricians are amiable. This is to consider electric lighting by itself and for itself, without regard to what may be doing in gas or oil lighting. If one so looks at the industry, it is easy to perceive that it is a great and a growing one, with its own particular work to do. There is more electric lighting done now than there was this time last year—and this is a good opportunity for stating that whoever wishes for the fullest obtainable information concerning the electric lighting undertakings at work in 1896 cannot do better than procure a copy of Mr. Emile Garcke's "Manual of Electrical Undertakings," just published, and noticed in the "JOURNAL" last week. There is much about some of these undertakings which Mr. Garcke does not tell, by the way; but, as a celebrated writer is fond of remarking, "that is another story."

The electric lighting interest of the United Kingdom finds itself at the close of another year somewhat advanced in certain respects, and very much where it was the year before in others. More central stations have been opened; and the older ones have in a few cases made a profit for their owners. But the progress along the latter line is not so considerable as could be desired. Several of the most favourably situated electric light undertakings in London and the largest cities of England and Scotland pay, as they did almost from the first. But it is very remarkable how slow the second-rate enterprises of the same kind, whether in London or the Provinces, are in arriving at this point. And it is abundantly clear that there are not a few electric lighting undertakings in existence that never will pay. Nothing has transpired during the past year to alter the prospects of central electricity supply stations. There has been much talk, and some performance, in relation to the suggestion of making towns' refuse do the electric lighting. But the only place where a complete plant designed to realize this ideal has been put to work is St. Pancras; and here the rubbish destructors can barely warm the feed-water for the boilers, to say nothing of making steam for the station. A few other localities are fated to learn an unpleasant lesson of the same kind before very long. A year or two ago, a desperate attempt was made by the firm of Messrs. Crompton and Co., and others, to create a day load for central stations, by popularizing the use of electric energy for cooking; but the movement obstinately refused to make headway. The day load is still to seek; and the same observation applies to economical storage of electricity.

The employment of gas-engines for generating electricity at central stations received a conspicuous exemplification at Belfast; and a small experiment of the kind, with engines driven by Dowson gas, was started at Leyton. The installation of private gas-power electric lighting plants was a thriving branch of the trade. A good deal was expected by electricians from the cheapening of incandescent lamps, in consequence of the expiry of the Edison and Swan master patent; but the experience of last year went to show that the market is so flooded with cheap and bad lamps, that the days of monopoly are to be regretted. Some undertakings were constrained, by troubles arising on this account, to supply their customers with lamps gratis, in order to keep them on their books. Everywhere the rivalry of the incandescent gas-lamp has been sorely felt by the electric lighting interest. After a heavy bill or two, and a worrying experience of bad lamps, the public are prone to fly to incandescent gas lighting for relief; and whereas a short time since it was usual to see, in shops and places of public resort, gas-fittings that had been adapted to carry electric lamps, now it is no uncommon sight to see electric light fittings adapted for incandescent gas-burners. No great things have as yet come of the new high-voltage incandescent electric lamps that were at one time expected to quite revolutionize electricity distribution. The electric lighting interest has derived some assistance from the introduction of what is known as the Brighton system of differential charging, by which those consumers who use their lamps during the longest period get a reduction as compared with the short timers; but the plan does not seem to work well everywhere.

The chief hope of electricians turned last year to traction. The application of electricity to tramway working by the trolley-

wire system proved popular in Bristol; and the system bids fair to be extended in places where appearances are not much regarded. A new and additional Metropolitan electric subway or two were proposed; and though no additional work of the kind was actually got into operation, progress was made with schemes which may eventually prove useful in relieving by this means the chronic congestion of many London streets. A sharp but brief recrudescence of speculation in matters electrical attended the opening of the roads, on Nov. 14, to mechanically driven carriages. An attempt was made to obtain money from the public for an electric omnibus venture; and an Electric Cab Company also showed, on paper, what accumulators could do by way of conveying passengers and luggage through the streets. No vehicle of either kind has yet taken its place upon the "rank;" and it seems only too certain that this attempt to rehabilitate a piece of electrical apparatus that has ruined more experimenters, and disappointed more hopes than any invention of modern times, is a mere repetition of the old story.

On the whole, therefore, it may be truthfully said of the electric lighting industry in 1896 that it has grown rather than improved. Its old defects remain with it. There have been the usual extinctions of street and private lamps, not a few fires due to short circuiting, and several casualties to workmen employed in generating stations. The Fire Offices have marked their sense of the development of the industry by increasing the rate of insurance for central stations to half-a-guinea per cent. It would not be correct to say of an industry representing many millions of invested capital, and served by a band of as able and devoted experts as ever undertook similar responsibilities, that it makes little or no progress; but it is perfectly obvious that, if the electrical enthusiasts of fifteen years ago could have seen the actual development of the industry, they would have moderated the language which they then habitually used respecting its prospects.

PERSONAL.

Mr. J. Brodie, of Gorebridge, was the successful candidate for the managership of the Kilmalcolm Gas-Works, rendered vacant by the appointment of Mr. W. Currie to Alexandria.

Mr. W. Mackie, assistant to Mr. Stewart at Greenock, has been appointed Manager of the Port Glasgow Gas-Works, in succession to Mr. M'Cubbin, whose intended resignation of the position was mentioned by our Scotch Correspondent a fortnight ago.

Mr. W. Titley, who for the past seven years has been rate collector to the Guildford Town Council, has accepted the offer of the Directors of the Guildford Gas Company of the Secretaryship, at a salary of £230 per annum—a position which has been relinquished by Mr. R. P. Simpson, formerly of Rugby. Prior to Mr. Titley's appointment as rate collector, he was for eleven years in the service of the Company.

Sir Thomas Meyrick, Bart., has offered the Pembroke Town Council an acre of land at Golden Hill for the construction of a water reservoir unconditionally, and has also granted way-leaves over his property as long as they are required; the only stipulation being that the tenantry shall be given a trifle for compensation. The Corporation are faced by a great expense in providing an adequate supply of water for the borough; and they have heartily thanked Sir Thomas for his generosity.

Iron Manufacture and the Kent Coal-Field.—In view of the development of the coal-field at Dover, the "Dover Standard" recently stated on very reliable authority that arrangements are being made for the re-establishment of iron-works on a large scale in Sussex, the neighbouring county to Kent. Iron ore is found plentifully in Sussex, which, until the year 1720, was the principal centre of iron manufacture in England; the iron rails round St. Paul's Cathedral having been cast in Sussex. The last furnace was extinguished at Ashburnham in 1828. The fuel used for the smelting was wood, but the county became denuded of timber, and, in consequence, Acts of Parliament were passed prohibiting the furnaces; and the manufacture of iron went northwards to the coal centres. It has only been the question of the price of coal which has prevented iron ore being worked in Sussex.

The Forthcoming Gas Exhibition in New York.—In the "Journal" for the 1st inst., we mentioned that Mr. James W. Helps, of Croydon, the President-Elect of the Southern District Association of Gas Engineers and Managers, had undertaken to forward to the Executive Committee of the above-named exhibition any articles connected with the manufacture and distribution of gas which would be calculated to form an interesting historical collection. The exhibition, it may be remembered, will be open for two weeks, commencing on the 25th prox., and as the time is now getting short, Mr. Helps will be glad to hear from any of our readers who may be in a position to render assistance in this matter by the loan of obsolete forms of pressure and register gauges, lamps, globes, burners, meters, and testing devices, as well as photographs of works, apparatus, &c. Mr. Helps will make the necessary arrangements for forwarding the articles to New York; and all expenses of carriage, insurance, &c., will be borne by the Executive Committee.

OBITUARY.

Frederick T. C. Linton.

As announced in this column last week, Frederick T. C. Linton, the Engineer and Manager of the works at Leith belonging to the Edinburgh and Leith Gas Commissioners, died at his residence, No. 6, Blacket Place, Edinburgh, on the morning of Sunday, the 20th inst. Mr. Linton was a native of Edinburgh; having been born in that city 56 years ago. His father, Mr. Thomas Linton, was for very many years the Chief Constable in the city, and Prosecutor in the Police Court. Frederick was his eldest son. After leaving school, Frederick Linton was at once apprenticed to Messrs. Bertram (now Bertrams, Limited), carrying on a general engineering business at St. Katherine's Works, Sciennes, Edinburgh. Having served his time, he proceeded to Birkenhead, where he was for a year or two in the employ of an engineering firm. When about twenty years of age, he turned his attention to gas engineering; and having obtained an appointment in the works of one of the Dundee Gas Companies, he repaired thither about 1860. He served there until he was able to transfer his services to the Edinburgh and Leith Gas Company, as assistant to the veteran Manager, Mr. John Reid. In addition to his acquirements as an engineer, and his practical knowledge of gas production and distribution, Mr. Linton had, by the time he received his Leith appointment, made himself thoroughly acquainted with the chemistry of the subject of gas making. Thus equipped, he entered upon his career at Leith—a career which has proved to be an unbroken success.

The date of his going to Leith would be about the year 1869. Mr. Reid was an aged man; and he retired four years after Mr. Linton joined the works. The Chairman of the Directors then was Mr. (afterwards Sir) Jas. Falshaw; and to him and his co-Directors Mr. Linton had so commended himself, by his efficient services, that they unanimously appointed him to take the post of Manager. When, in August, 1888, the Corporations of Edinburgh and Leith took over the undertakings of the Edinburgh Gaslight Company and of the Edinburgh and Leith Gaslight Company, they retained the services of the Managers of both the Companies' works; and Mr. Linton accordingly remained in the post of Manager down to the date of his death. His management of the Leith Gas-Works was invariably of the most enlightened description. When he became Manager, there was a keen rivalry between his and the Edinburgh Company. The latter Company was under the direction of the late Mr. J. K. Watson, who was a king among those who had the control of gas undertakings. Mr. Watson's Company all along paid a 10 per cent. dividend; and it is matter of history that he insisted upon the Leith Company not paying more than 8 per cent. This restriction made the opportunity of the Leith Company. Earning sufficient profit to enable them to pay more than 8 per cent., and being unable to pay it except upon pain of opposition in the matter of price—which, being the junior Company, they were not prepared to enter into—they began the policy of putting their surplus earnings into their works. Whether or not Mr. Linton was the originator of the policy, cannot be said; but it fell to him to direct it. The whole plant, manufacturing and distributive, was put into the best condition. Siemens's regenerative furnaces were introduced in the retort-house; Mr. Linton being among the first in Scotland to recognize the value of the system. The gasholder department was extended, until it was nearly a quarter of a million cubic feet more than the maximum day's consumption. With regard to the efficiency of the distributing system, when Mr. Linton went to Leith, he found the unaccounted-for gas at 22 per cent.; and he brought it down to 5·9 per cent. Not satisfied that this figure was really leakage, he put thermometers into the mains; and by a system of readings extending over three years, he came to the conclusion that 3 per cent. was due to shrinkage in bulk, from variations in temperature, and only 2·9 per cent. was leakage. The effect of this good management on the part of Mr. Linton was that, when the transfer was effected, the Corporations, though anxious to take over the Leith Company upon the basis of 8 per cent. annuities, were obliged to agree to pay annuities at the rate of 9¼ per cent., and to take over mortgages and bank loans to the amount of £31,700.

After he became a Corporation servant, the trust which was reposed in Mr. Linton by the Directors of the Company was all along continued by the Gas Commissioners; and he fully merited it. His report on the Peebles Oil-Gas Process in April, 1893, was a most exhaustive production, and greatly influenced the minds of those who have since adopted the process. In November of the same year, he reported on a series of experiments in the making of gas from peat, which he had undertaken at the request of the Commissioners; and he condemned the proposal. When the Commissioners, in the beginning of 1895, were considering as to the introduction of carburetted water-gas plant into the Edinburgh works, he was asked to report on the subject. He did so with great minuteness; the conclusion he came to being that the Commissioners should defer coming to a conclusion on the subject till it should be seen whether there was to be a conflict as to patent rights between the owners of the Peebles process and Messrs. Humphreys and Glasgow. This was the last work he did for the Commissioners outside his ordinary duties as Manager.

Mr. Linton had for years suffered from the malady which led to his death. For a long time it was regarded as catarrh of the stomach; but latterly his medical advisers ascertained that it was in reality a malignant ulcer in the stomach. The ailment was a most painful one. He subsisted for several years upon specially prepared foods; and, without carrying his cooking establishment along with him, he had been unable to be absent from his own home, during at least the last two years, for a greater period than the interval between two meals. Until two years ago, he lived in a dwelling close to the works at Leith; but the situation was insalubrious, and (acting on medical advice) he then removed to a more favoured locality in the Newington district of Edinburgh. Since then the active duties of the management have been conducted by Mr. A. J. Walker, the first assistant at the works—Mr. Linton being able, however, to supervise all that was being done. Last autumn he went with his household to Harrogate; and while there, his ailment developed rapidly. He was unable to return at the time his holiday expired, but was able to resume his duties some time during September. Though far from well, he attended a meeting of the Commissioners on Oct. 1; but after that he was unable to attend in his place. For the past week or two he was in great weakness, and suffered much. His end was, therefore, not unlooked for. When the transfer took place, in 1888, Mr. Linton was scheduled in the Act of Parliament for a pension of £450 a year. Recently, on account of his state of health, he had expressed a desire to get quit of the cares of office, and to retire upon his pension. On Nov. 30, the Commissioners, having this in view, remitted to a Special Committee to consider the whole subject of the engineering staff. The Committee met on the 14th inst., and resolved to recommend that Mr. Linton be allowed to retire on his statutory pension; and the recommendation was to have been considered by the Commissioners at their meeting on Monday of last week. On the previous day, however, Mr. Linton died.

As a man, it may be said of Mr. Linton that integrity was stamped upon his countenance. Though he never courted popularity—on the contrary, he stood stedfastly to his duties, and in his leisure moments sought his recreation in the byways of art and literature—he was everywhere a much-respected man. It may savour of flattery, but it is nevertheless the fact that in dealing with Mr. Linton one felt in the presence of a man who exhibited in the highest possible degree the qualities of uprightness, veracity, and fidelity. Outside the gas-works his tastes led him to seek membership in the Edinburgh Architectural Association, the recently formed Sir Walter Scott Club, and the Early English Text Society. He had few other connections. There is, however, one which cannot be passed over. He was a devoted member of the Scottish Episcopal Church; and for 26 years he held the honourable office of Chief Vestryman and Clerk to the Vestry in St. James's Church, Leith.

As a gas manager, Mr. Linton was in the front line, and was widely known as such; but, except in reports to his employers, which were marvels of exactitude, he has left behind him hardly any literature relative to the industry. He was President of the North British Association of Gas Managers in 1884; and at their annual meeting in Glasgow he delivered the presidential address. He was a member of the Institution of Gas Engineers, but never contributed anything to their "Transactions."

Mr. Linton is survived by his widow, but no family. His remains were buried last Wednesday afternoon at the Grange Cemetery. There was a large attendance of the Gas Commissioners and other friends of the deceased, including a numerous representation of the workpeople from the Leith Gas-Works, in whose name Mr. Walker, the Assistant-Manager, placed a handsome floral wreath upon the grave.

Mr. William Eley, of Wolstanton, one of the promoters of the Burslem Gas Company and likewise of the Staffordshire Potteries Water-Works Company, has recently died at the age of 76.

The death is announced of Mr. Robert Winter, at the age of 71, at his residence, St. Mary Cray, after a very short illness. Deceased was the Manager of the Crays Gas-Works from the time of their establishment down to 1888.

Mr. John Nash, who at one time held the position of Chairman of the Farnham Gas Company, and was a Director of the Farnham Water Company, died last Wednesday, in his 85th year. Deceased had been associated for many years with the management of the affairs of the town.

The death is announced of Dr. Goodridge, who has been a member of the Paignton District Council since its formation, and for many years was Chairman of the previous Local Board. At the time of his death, he occupied the position of Chairman of the Water Committee, and was remarkably attentive to the duties appertaining thereto.

Last Sunday, Sir John Brown, of the Atlas Works, Sheffield, died at Bromley, Kent, in his 81st year. Deceased was one of the most remarkable men of his age; for, commencing life as an unknown boy, he became one of the foremost citizens of Sheffield—his career being practically the history of that town during the past half century. He was the son of a slater, and was apprenticed to Messrs. Earl, Horton, and Co., merchants and manufacturers. He exhibited so much business ability, that soon after he was twenty-one he was made a partner in the concern. In 1844, he disposed of the business, and commenced the manufacture of steel files and springs. In 1855, he bought works in Savile Street, greatly enlarged them, and, naming them the Atlas Works, concentrated all the branches of his trade under one roof. He was one of the first ironmasters to recognize the value and importance of the Bessemer process of making steel; and he obtained a licence to work the patent. In 1860, he commenced the manufacture of armour plates; and two years later, he was able to show a number of distinguished visitors to his works the process of rolling a steel plate 3 ft. 9 in. wide, 18 ft. 6 in. long, and 5½ in. thick—a gigantic plate, as then considered, but dwarfed into insignificance by what has since been accomplished. In 1863, Sir John erected a new mill, larger and more powerful than anything hitherto thought of, by which a plate 12 inches thick and 20 feet long was produced. The number of people employed at the Atlas Works was now more than 4000; and the turnover touched a million a year. In 1864, the business was converted into a Company—Sir John retaining the chairmanship of the Directors down to 1871. Those of our readers who attended the meeting of The Gas Institute in Sheffield in 1883 will doubtless recollect the interesting afternoon spent at the works by the large party who accepted the invitation of the Directors. From 1874, Sir John held the post of Chairman of Earle's Shipbuilding Company, at Hull; and he was largely interested in the Bilbao Iron Ore Company, and was a Director of the Great Northern Railway Company. In his day, he filled the offices of Mayor, of Master Cutler, and almost every position of trust and honour in Sheffield to which his fellow-townsmen could elect him. He was the first Chairman of the Sheffield School Board; and the success which attended its earlier efforts was largely due to his enlightened policy. He had been in failing health for some years before his decease, and lived in the South of England by medical advice.

NOTES.

The Use of Coke as Fuel for Road Motor Cars.

In the course of a paper on "Mechanical Road Carriages," read before the Society of Arts by Mr. W. Worby Beaumont, mention was made of the Serpollet System as developed in France. The author remarked that the Serpollet instantaneous generation boiler seemed at one time to be likely to meet the requirements of this essential part of the equipment of a steam-motor carriage; but the weight of it and of its case and the coke fuel are against it. Still, Mr. Beaumont thinks that even yet, with certain modifications, the Serpollet boiler may provide all that is required. For the last year, M. Serpollet has confined his attention to tramcar propulsion, in which field he has attained considerable success, using coke for fuel. In 1889, M. Serpollet constructed a steam tricycle, also burning coke. Mr. Beaumont appeared to think the employment of coke as fuel was against the prospects of the Serpollet system; but the Chairman of the meeting, Sir Frederick Bramwell, observed upon this that he did not know what objection there is to coke as a fuel, when properly used. All fuel must give off carbonic acid if burnt perfectly, and carbonic oxide if burnt imperfectly; and he did not know that coke gave off anything else. Mr. Sennett also stated that he had the same day driven some 30 miles with a Serpollet carriage stoked with coke. The ash-pit doors in this car are towards the front, and the blast up through the fire due to the motion of the car is all that is required. The advantage of coke is that it lends itself to automatic firing, and is much cleaner than petroleum. The driver need not attend to the fire; the reserve of fuel is carried in a hopper, and the motion of the carriage shakes it down. "That afternoon they had rather less than one sack of coke put into the hopper at Worthing; and, as a precaution, about a quarter of a sack more was put on the front of the carriage. They ran the 25 miles into Horsham with the use of about three parts of a sack." From this statement, it would appear that the oil-motor is not likely to have the monopoly of the road, to the exclusion of the steam-engine with a boiler fed with coke.

The Internal Corrosion of Steam-Boilers.

A good paper on the subject of internal corrosion in steam-boilers was read recently before the Institute of Engineers and Shipbuilders in Scotland by Mr. Sinclair Couper, the Managing Partner of the Moore Park Boiler Works, Govan, and consequently an authority on the matter. The text of the paper was published in the "Engineer" for the 4th inst. Dealing with the causes of the internal corrosion of boilers, Mr. Couper reviewed the most familiar hypotheses that have been put forward to account for this effect. Chief among these is that of galvanic action, supposed to be set up between different structural elements in boilers. Mr. Couper regards it as not proved that galvanic action takes place in a steam-boiler under ordinary conditions of working, or, if it is present, that it is the chief cause of any corrosion which takes place. Another theory of corrosion is that it is due to the effects of certain gases, notably oxygen and carbonic acid, introduced with the feed water and then liberated. Mr. Couper thinks this the correct explanation of many cases of local and general corrosion; the former consisting of pitting, and the latter of a reduction of the

thickness of the metal over a considerable area. The corrosion of feed-water heaters is probably due to this cause. Mr. Couper recommended that the discharge of feed water into boilers should be near the surface of the water, so that all air entering with the feed may be carried off at once by the steam. Another cause of corrosion, and a very common and active one, is the presence of fatty acids in the boiler. These are the result of the decomposition of animal or vegetable oils or fats which have been exposed to heat either in the boiler itself or in the cylinders of the engine. One lesson to be drawn from this chemical fact is that nothing but the best mineral oil should be used in the cylinders of engines which return the condensed steam to the boilers. Mr. Couper stated several points as well worth the attention of those who have to do with steam-boilers. Every new boiler should be carefully cleaned and washed out before being used for the purpose of raising steam. After a preliminary or trial run, more especially with surface condensing engines, scumming should be resorted to, and then all the water remaining in the boiler should be blown out and the boilers again cleaned. When refilled, some soda should be put in; and when steam is again raised, the scum-cock should be frequently used. All feed water should be as pure as possible, and free from grease. The high-level feed has already been mentioned. The blow-off cock should be so arranged as to completely empty the boiler. The entrance of air with the feed water should be prevented as far as possible, and the addition of a little lime to a pure water is a good corrective of corrosion by air.

The Removal of Sulphate of Iron from Water.—Sulphate of iron is being removed from the ground water supply of Reading (Mass.) by the addition of milk of lime, combined with thorough aëration and rapid filtration; the treatment proceeding in the order named. This process was adopted by the Water Commissioners after a series of investigations carried on over a period of two or three years.

Screening and Tipping Coal.—In a paper on this subject, read on the 8th inst., by Mr. J. Rigg, before the Institution of Civil Engineers, he gave an account of the various kinds of machinery employed in recent practice, and stated that greater importance is now placed upon the preservation of coal from damage in loading, screening, and transit than formerly, on account of the keener competition in the supply for domestic purposes. The rate of increase in the amount of coal raised in the United Kingdom for manufacturing purposes had far exceeded that for domestic use; so that the supply per head of the population was now more than double what it was 33 years ago, while the population had barely increased 50 per cent.

A New Stiffening Fluid for Welsbach Mantles.—A fluid, to which the name "Stabil" has been given, has recently been introduced from the laboratory of Herr C. O. Mecklenburg, at Berlin, for the purpose of imparting to mantles the stiffness and elasticity necessary for their safe transport. The mantles are prepared and incinerated in the ordinary manner, and then placed side by side on a long rod. The stiffening fluid is poured into a tumbler-shaped vessel, and the suspended mantles are immersed in it in turn. Four hours must be allowed for drying; and the mantles will then bear careful handling. One advantage claimed for this fluid is that it may be burnt off after the chimney has been placed on the burner, with no risk of shattering the glass.

Dunkley's Gas-Motor Carriage.—In the "Editorial Notes" in the "JOURNAL" for the 17th ult., reference was made to a vehicle devised by Mr. W. H. Dunkley, of Birmingham, for use on common roads, with coal gas as the motive power. We have received from Mr. Dunkley, who is a noted perambulator maker, a photograph of the vehicle, which closely resembles a couple of bath chairs, constructed of basket twig, placed back to back over a pair of wheels, with a single wheel in front and behind for steering. Both of these wheels are connected; and the movements of the vehicle can be directed by either of the occupants. The great feature of the carriage, however, as far as we are concerned, is the gas-engine, with the arrangements for storage. The gas receptacles consist of a couple of steel cylinders, 30 in. by 7 in., placed lengthwise under the carriage. Over these, fitted in a small box-like structure, is the engine. The cylinders are charged with compressed gas by a small pump; and in a short time something like 120 cubic feet—more than sufficient for a day's requirements—can be stored. A vehicle capable of carrying two persons, and in constant use, would not, it is stated, consume more than 1000 cubic feet of gas per week; while it is computed that one-fifth of this quantity would be sufficient to run the vehicle 100 miles. The extent of the storage capacity would depend entirely upon the wish of the purchaser. However, the renewal of the supply need not take place more frequently than once a day; and it can be effected by attaching a specially-made "sucker" to an ordinary gas-burner. The vehicle is noiseless and—what is of equal importance—odourless. The inventor states that he is able to run his vehicle up to 20 or 30 miles an hour—a pace much greater than is likely to be allowed in the public streets. The speed, however, can be regulated as required; and the provision of ample brake power and reversing gear will, it is claimed, ensure the carriage being under perfect control.

COMMUNICATED ARTICLE.

TESTING GAS COAL.

By NORTON H. HUMPHRYS, Assoc. M. Inst. C.E., F.C.S.

I have read Mr. T. Glover's paper on the "Commercial Testing of Gas Coal," which appears in your issue of the 3rd ult., and also the discussion on the same, with some amount of disappointment. The testing of gas coal is a very important subject; and I had hoped to find some advancement or improvement in details. But the only innovations in the set of apparatus illustrated, are the introduction of two retorts instead of one, and the plan of drawing off a sample of gas for examination at a regular rate. No experimental data or other proof is adduced in favour of these, or to show how they aid in producing the superior results as compared with other forms of testing apparatus that are more than once claimed in the paper. While heartily agreeing with many of the conclusions advanced, I fail to follow the line of reasoning adopted in some instances; and with regard to others, while open to conviction, I should wish to see them supported by experimental proof. The general interest attaching to the subject, must be my excuse for taking the liberty of freely discussing the paper, in the hope of assisting, to some small extent, in the advancement of the same.

Every gas engineer rides his own pet hobby on this question of coal testing, and not unfrequently also carries a decided personal conviction that all tests which do not strictly conform to the said hobby are unreliable, if not useless. I will venture to go further, and say that the same individual changes in his attitude towards it from time to time; and this appears largely due to want of a clear comprehension of what the test is, and what it is intended to show. We hear of laboratory tests, experimental tests, working tests, and commercial tests. But these may be divided into two classes—the experimental test and the commercial test. Directly these are mixed together, confusion arises, because the experimental apparatus cannot take hold of all the details of £ *s. d.* which are the principal feature of a commercial test; while apparatus on the ordinary working or large scale brings in special sources of error, which take away from the definiteness that should attach to an experiment. An indispensable feature of any experiment is that it should be definite. If repeated several times, the results should be the same—or, at any rate, without appreciable variation. It is possible, with reasonable care and skill, to conform to this condition with a laboratory apparatus of the usual capacity—viz., 1-1000th of a ton. But on the large scale, there are practical contingencies—such as the condition of the sample, the way it is handled, the heats of the retorts, the temperature of the condensers and of the washing liquor, and the state of the purifiers—which prevent anything like a close approach to definiteness.

Each description of test has its proper place; but neither can supply or fill the position of the other. The experimental test gives us the practical character of the coal, by which it can be identified at any future time. The external characteristics, colour of ash, percentage of volatile compounds, quality, quantity, and composition of gas produced, percentage of coke, and so on, together with its behaviour during combustion and distillation, enable an experienced operator to classify it, and assess its practical value. A moderate amount of practice in experimental testing, renders the operator able to judge as to the desirability or otherwise of testing a few trucks of the coal in the usual way. So far it is a question of quantity and quality of products. But the commercial test brings in the question of £ *s. d.*; and to give a really reliable result, it should deal with ordinary working conditions of handling the material and its products, and of purchasing and selling. Every gas manager is engaged in making commercial tests of the particular kinds of coal specified in his current contracts. The experimental test tells us the intrinsic value of the material; and the commercial test shows if it can be made the means of satisfying the consumers and paying the dividends.

A very general impression seems to exist, to the effect that the experimental test should be a sort of standard, representing the best results that can, by the exercise of reasonable care and skill, be obtained in every-day working; and it has been roundly abused because it sometimes appears to soar out of the reach of this very indefinite condition. If every gas-works was an exact reproduction of one common plan, like the moulds from one casting, and subject to similar climatic conditions, it might be expected that the every-day working would be a definite quantity, and that the experimental test should closely approximate, or, at any rate, be in fixed proportion thereto. But remembering the varying practice in respect to apparatus and modes of working, is there much to be wondered at if the experimental and commercial tests sometimes run out to considerable distances apart from each other? While as a general rule the gas manager desires to get as much gas as possible out of his coal, and regards every additional 100 cubic feet as a gain, it sometimes happens that he does not care to gather up the last threads, as the extra few 100 feet may cost more than they are worth. The additional fuel, wear and tear of retorts, and purifying expenses may render them a loss rather than a gain. The idea of making the experimental test of coal a perfect and

complete miniature of every-day working is a delusion. Should it, to be reliable, conform to the 8000 cubic feet per ton of 1840, the 10,000 cubic feet of 1870, or the 11,000 cubic feet of 1896? There is no finality about ordinary every-day working; and it is notorious that in the case of two or three different gas-works, each using the same description of coal, the results differ considerably. A test that happened to agree with the particular circumstances of one works, would be wrong as regards the others. The experimental test, therefore, cannot do more than give a correct description of the character of the coal. From this the qualified gas manager will be able to calculate, with tolerable closeness, its value at his own works. It is more valuable for this purpose than a commercial test, when the results are printed for the guidance of others; but what I wish to make clear is that printed results, whether experimental or commercial, must be viewed from the point of the reader's particular circumstances. It is not sufficient to know that certain results were gained with the coal; the inquirer has to consider whether he could secure similar ones at his own works, or how near he could approach to them.

It is quite true, as the author observes, that the results gained from actual working with his own experimental apparatus, will be more valuable than a mere perusal of printed analyses. An actual test, even if made in a rough-and-ready manner, gives an insight into the character of the coal that cannot be obtained by simply reading a report; but this is no discredit to the report. In regard to the printed report, also, the date at which it was prepared, and the manner in which the sample tested was obtained, are important considerations in assessing its value. An analysis that was made ten or fifteen years ago can scarcely be taken as a correct example of the characteristics of a coal at the present day; and a sample that has possibly been packed up in the pit itself, and conveyed high and dry to the test-room, may be expected to give better results than an average sample from the gas-works yard, which has received the usual transferring from one receptacle to another, throwing out or tipping up, exposure to weather, &c. In the experimental test, the coal can be distilled at an accurately adjusted temperature in a perfectly sound retort—conditions which do not obtain in practice; but it is hopeless to attempt to discount these advantages, with a view of improving the "practical value" of the test. How can such matters as cracks in retorts, stopped ascension pipes, transit of coal for 200 or 300 miles, or exposure to six months' bad weather, be represented in a testing-room?

The author thinks it advisable to make periodical experimental tests of well-known coals; and from the second paragraph in the paper, it would appear that the expression "well-known" refers to the coal which the operator has been in the habit of using in the ordinary way of business. He warns gas engineers that, if they continue to use such coals without observing such precautions, their confidence may be carried too far. But what creates "confidence" in a gas coal, or leads the gas manager to prefer it? Simply the commercial results. Let us assume that, whether by the aid of experimental tests or otherwise, the gas manager has made a judicious selection of coal. After he has had a few years' experience, he knows exactly what he can do with the coal. He is also aware, if he possesses any powers of observation and reasoning at all, of the weak points of his carbonizing and purifying apparatus, and whether they admit of remedy. He may go on using the coal for twenty years, if the results continue satisfactory and the price is right, without the periodical experimental test. If the quality of the coal is not maintained, he will find it out from his working results, without needing to go to the laboratory to inquire; though if his results do show a failing, the experimental test will be very useful in helping to locate the cause. But so long as the working results are good, I fail to see the necessity for the periodical experimental tests, or why the results of such a test, if taken, should be likely to cause "no little surprise." Granted that the working results remain unaltered, an accurate experimental test should simply agree with previous similar ones, and would not be likely to elicit any information that was not known before. Apart from this question, as a matter of research the gas engineer will find it worth while to make experimental tests—especially with certain modifications of the purifying and condensing arrangements—and compare the same with his daily working. But I take it that the usefulness of the experimental test becomes more apparent in regard to coals that are not "well known." A gas engineer cannot be sure that he has selected the coal best adapted to his circumstances, until he has examined all likely descriptions within reach. These may total up to perhaps fifty; and life is not long enough to make a commercial test of all. He must follow the example of Mr. C. E. Jones, who remarked that he had tested nearly all the coals in the Midland district. By this means, Mr. Jones has obtained an insight into the nature of some kinds of coal in regard to which a commercial test would have proved a troublesome and costly experiment; and the author himself gives an illustration of the advantage of an experimental test in regard to a new gas coal. I think that all who have made a habit of regularly examining samples of every fresh kind of coal, will occasionally make a lucky find, and hit upon a good article in a quarter, perhaps, where it was least expected.

Passing on to notice some of the details incidental to Mr. Glover's apparatus, I deal first with his assertion that, by using two or more retorts, and thus mixing the heavy gas from the first part of a charge with the light gas from the latter part of a preceding charge, he obtains better and more accurate results. Whether there really is any loss of illuminating value by the deposition of matters that might otherwise be retained in the gas, when working on the experimental scale, is a matter which I have never actually inquired into; but from the condition of the tar, and the fact that the illuminating value obtained from the single retort is almost invariably in excess of that shown by every-day practice, I should much doubt it. We know that in ordinary working some time elapses after the introduction of the charge before the proper gas-yielding temperature is gained in the retort, on account of the cooling effect of such a large bulk of comparatively cold material; and heavy vapours escape that possibly carry valuable illuminants with them, and which, but for the diluting action of lighter gases, would find their way to the tar-well. But this would not be so likely to obtain in a small iron retort.

It would be extremely interesting to know whether any improvement in illuminating value is shown by the author's system of two or more retorts, as compared with the usual single retort; but whatever the advantage may be, it is very dearly bought. With a single retort and gaseous fuel, the consumption of gas, and therefore the temperature of the retort, can be nicely regulated. The author's drawing shows an ordinary coke furnace for heating; but it would be possible to adopt gas heating, which I regard as indispensable to a reliable experimental test. Yet even with every care, the working temperature of two retorts cannot be so closely adjusted as that of one; and the two retorts also necessitate the introduction of the hydraulic seal—an objectionable feature in an experimental apparatus. However carefully adjusted, it gives a variable pressure on the retort; and if concordant results are desired, the pressure in the retort during the operation should be perfectly steady, and within a tenth or so of that of the atmosphere. My chief objection, however, to the use of more than one retort is that it prevents the rate of production from any one single charge being watched. With a single retort, the height of the holder can be read at any desired interval—say, two to five minutes—and the curve showing the rate of production is one of the most valuable indications of the practical value of a coal that it is possible to obtain. The author mentions hourly charges; but with the two retorts, how can he tell when the charge is completely worked off? He runs a risk of spoiling his test by opening a retort before the proper time, or of leaving a spent charge standing in the retort after it is worked off. With the single retort, the holder can be watched and the charge withdrawn at the minute that its carbonization is completed. I may be told that the hydraulic seal and the uncertainty as to drawing the charge are an approach to practical conditions. Perhaps so. But, as already remarked, if we once start at a reproduction of practical disadvantages in the experimental plant, where are we to stop? The duplication of the retort certainly serves to reduce the errors inseparable from another special feature—that of drawing off a sample of the gas at a regular rate, which is supposed to represent a fair average of the total make. But apart from this, I do not see how it contributes towards a nearer approach to accuracy.

Another special feature for which some advantage is claimed is the use of 56 lb. charges; bringing the consumption of coal up to 2 cwt. or so. It is claimed that the results obtained are of "much more practical value" than those based on the distillation of "a few pounds"—alluding, I presume, to the 1000th of a ton testing apparatus. If there is anything in this idea, why stop at 56 lbs. It would follow that the nearer we approach to ordinary working, the more accurate the result, or rather the greater the "practical value." The 1000th of a ton retort would be farthest away; and the two retorts with 56 lb. charges rather nearer, but still very far removed from ordinary working. If a representation of ordinary every-day results is the object sought after, why go to the expense of experimental retorts at all? The first cost and working expenses of such a setting as is shown in the drawing would be considerable; so why not isolate a particular bed of retorts, and arrange a small condensing and purifying apparatus for dealing with the make therefrom? Of course, proper precautions must be taken in selecting the sample, whether large or small; but, given a sample weighing 2 cwt. or so, I fail to see in what way the carbonization of the whole bulk is likely to give more accurate results than the selection of fair average samples therefrom. In analyzing oxide, lime, liquor, &c., it is usual to operate upon much smaller quantities than 2¼ lbs. Why not claim that oxide should be tested by the 56 lbs., or that ammoniacal liquor should be analyzed on the 100 gallons, as the results thus obtained would be of "more practical value" than those obtained from the 100 grains or the 50 septems in the usual way? I contend that 2·24 lbs. is in every way a more convenient quantity for accurate operations than 56 lbs. While not so small as to interfere with fair sampling, it can be readily weighed out to within less than a grain. I have repeatedly taken four to six charges from a large bulk; and the regularity of the results has shown that the sampling was everything that could be desired. The coke can be collected and weighed with equal delicacy; the liquid products are obtained in convenient quantities for measuring or analyzing, and the same with regard to the impurities. The whole of the gas, being collected in one vessel,

can be dealt with in any desired way; and I am therefore not only unable to see where the advantage of enlarging the apparatus some forty-fold would come in, but think there are decided objections to doing so.

The author mentions that the coke should be weighed hot. But a very much better plan is to weigh it cold; and I am under the impression that this is the usual practice. Red-hot coke exposed to air loses weight by combustion; the induced current of hot air interferes with the steadiness of the scales; and the heat interferes with their accuracy. The plan of weighing hot is preferable to quenching with water and leaving the coke to drain or dry for twelve hours, which has been suggested; but my own practice is to provide a light wrought-iron box, so shaped as to fit snugly under the mouthpiece. The charge is drawn rapidly into it; and the lid, which is close fitting and has a rim about 3 inches deep, is placed on. In an hour or two, the box and its contents will be cold, and can be weighed. The coke is then emptied out, and the empty vessel weighed. By this means, the weight of the coke is obtained without risk of loss by handling; and the difference between charges from the same sample will not exceed 10 grains. I have noticed that the coke smothered in this manner is more friable than it would be if extinguished with water—a fact that must be remembered if it is desired to estimate the quality of the coke.

The plan of drawing off a sample of the gas at a regular rate, to represent a fair average of the whole, is defective. If the production was always regular, it would secure a fair sample; but this condition is impossible of attainment. The two retorts tend to "level up" to some extent; but even with them, the rate of production from minute to minute will vary with every kind of coal. To get an accurate sample, the proportion between the total make per minute and the quantity withdrawn per minute must be constant; and this is impossible where one is fixed and the other variable. Those, however, who are in favour of sampling the gas made, should refer to the description of Mann's proportional meter, given in "King's Treatise," Vol. I., p. 98, which is an apparatus that would ensure fair sampling. I also gather that Mr. Glover depends on the pull of his exhauster for relieving the pressure on the retorts, which is a somewhat rough-and-ready way of proceeding, and does not admit of such regular working as is practicable when the gasholder is weighted or counterbalanced to adjust the pressure.

Mr. Glover's results are greatly discounted, from an experimental point of view, by their silence in respect to the liquid products. It is not a question of the practical value of the tar and liquor, but of checking and balancing there sults. If worth doing at all, coal testing is worth doing well and completely; and one cannot be certain as to the correctness of his results unless the whole of the products are collected and a kind of balance-sheet made out, showing that the weight of coal used is represented by the gas and products. How else would such a thing as a crack in the retort, a small leak in the apparatus, or an error in weighing or measuring be detected? The quantity and specific gravity of the tar is also an important point in estimating the practical value of the material, especially when dealing with an unknown mineral of which only a small sample is obtainable—such as (say) Japanese or Australian coal. Another disadvantage connected with such a large set of apparatus, is that the condensers, scrubber, and purifiers are outside the building, exposed to the vicissitudes of the weather. They are therefore subject to changes of temperature which may cause trouble, and are not conducive to accurate or to definite results.

After having shot with so much freedom at Mr. Glover's views upon coal-testing, it is only fair to give him a chance of retaliating; and so I will conclude by outlining the special features of a testing apparatus which was arranged some fifteen years ago, and has been regularly used ever since: One cast-iron retort, heated by a Fletcher's gas-burner, the latter fitted with a meter and regulator; ascension and other connections throughout, 1-inch bore; ascension short, surrounded with a water jacket, terminating with a cross-piece. From this a short horizontal, terminating in a second cross, with rising pipe to the condenser; to the lower limb of the second cross the "tar vessel"—a tin cylinder or bottle, with the neck formed of a piece of 1-inch pipe, so that it can be screwed on and off—is attached. The condenser consists of a 2-inch pipe in one straight length, with a fall towards the inlet, and the length can be varied; then two scrubbers and the dry purifier; and, lastly, the holder. If necessary, a small tar extractor can be introduced at the outlet of the condenser; and the scrubbers or purifiers are detachable. In fact, the arrangement of apparatus from the tar vessel to the holder is so designed as to be varied according to the kind of coal or oil being operated on. The whole is arranged to admit of cleaning out from end to end by the removal of plugs or covers. There are pressure or sampling tubes at intervals, and a connection from the gasholder into the photometer room.

An Agglutinating Material for Making Briquettes is produced, according to a process patented by M. Zendroni, by introducing the following materials into a rotating steam-jacketed cylinder kept at a temperature of about 200° C.: 500 kilos. of pitch, 50 kilos. of resin, 100 kilos. of napthalene, 100 kilos. of calcium carbide, 50 kilos. of lime, and 800 kilos. of well-ground coal.

TECHNICAL RECORD.

COAL DUST AND COLLIERY EXPLOSIONS.

At the last Meeting of the Bristol Association of Engineers, Mr. DONALD M. D. STUART, F.G.S., read a paper entitled "The Rationale of Colliery Explosions from Coal Dust," of which the following is an epitome.

The author gave an account of the phenomena observed in his examinations of the Camerton and Timsbury Collieries after the explosions in 1893 and 1895. He showed that these mines were free from fire-damp or inflammable gases, and that coal dust was the only explosive agent present at the origin, and co-extensive with the area of disturbance. The phenomena in connection with the explosions were shown by drawings and the oxy-hydrogen light. These drawings indicated that the coal dust at the points of origin had undergone destructive distillation, leaving residues of coal coke; and evidence of the same action prevailed at other points in the fields of explosion, showing that the volatile part of the coal had been extracted, and flowed into the atmosphere of the mine, forming with the air explosive gaseous mixtures, which caused explosions at varying distances. From his observations and measurements, Mr. Stuart proceeded by induction to explain the causes of the explosions. He dealt at length with all the chemical changes induced and brought about by the explosions; pointing out that the element of time was required for distillation, and giving evidence that its condition did exist. He raised the question of heat, and showed that the series of chemical changes provided it, and that his theory accounted for, and harmonized with, all the phenomena of explosions. Mr. Stuart then examined the phenomena of explosions in mines yielding fire-damp; showing that while some explosions were due to fire-damp alone, the principal calamities were due to coal dust, inasmuch as their phenomena were identical with the explosions from coal dust in the cases defined.

The PRESIDENT (Mr. J. M. M'Currich, M.Inst.C.E.), in opening the discussion, remarked that Mr. Stuart had brought forward a new theory to explain what occurred in colliery explosions. It was founded upon extensive examination and research; and if the views he had advanced upon the facts presented proved to be the right interpretation, their acceptance would lead to the prevention of such calamities. An important part of the subject was the source and quantity of heat necessary for producing the explosive phenomena with coal dust in mines; and Mr. Stuart was the first investigator to take up this branch of the question. He had shown that the amount of heat derivable from charges of explosive was utterly inadequate for the purpose of an extensive explosion through a mine, and had suggested the source of the supplementary quantities required to produce the far-reaching effects observed.

Mr. T. MORGAN, M.Inst.C.E., a mining engineer, thought it was difficult to understand why the men at the shaft at the Camerton Colliery felt so little effect of the explosion, seeing that a simple additional pressure upon the governors at a gas-works was instantaneously felt at the end of a main four miles distant. He did not understand how oxygen came to be present in the stagnant atmosphere between the falls of roof caused by the separate explosions, as it was supposed all the oxygen had been consumed by the explosions, and the places were hermetically sealed by the falls. It appeared to him to be impossible to obtain the destructive distillation of coal except in a retort; and such distillation could not take place in the presence of oxygen. He thought that the coal dust in the mine must be burned, and that the disruptions were due to very fine coal dust occurring at these *loci* of disruption. He inquired if the explosions could not be produced apart from hydrogen, and stated that he could not accept the suggestion that the coal missing from the end of the tram had been disintegrated and removed by heat, since such heat must have consumed the tram.

Mr. J. S. MARTIN (H.M. Inspector of Mines) observed that the accounts Mr. Stuart had given of the explosions at the Camerton and Timsbury Collieries were accurate; but he disagreed with the hypothesis that falls of roof were evidence of explosions at these points, as the timbering in mines varied greatly. In some places, the roof was like rock, and an explosion could occur there and not disturb it; at others, the timber was so locked and keyed in by pressure that an explosion would not disturb it; while at others, a slight movement would cause the timber to fall like a pack of cards. He thought the destruction of doors in roads at right angles to the path of the blast was due to the obstructions they caused to the expansion of the gases.

Professor RYAN did not admit the process of volatilization preceding each disruption. He said he considered that the coal dust itself was the sole cause of the disruptions, as in explosions of flour, owing to the great expansion at the high temperature present; and that flame travelled in explosion for some distance, causing flickering explosions at the expansion of the wave. He thought further that the disruptions were due to the coal dust being much finer at these points, and consequently undergoing more rapid burning. He added that, if Mr. Stuart's observations were that the disruptions were found

where the air or oxygen was abnormal in quantity or concentrated, then his own suggestion was difficult to sustain. He thought that any ordinary moisture would not stop an explosion, as it would be wiped up by the gases at the great temperature under notice.

Dr. J. W. JAMES agreed with most of what Mr. Stuart had said upon the chemistry of the subject. It was established by the experimental researches of Hengler that an explosion could not be produced by a solid yielding combustible gases, and depending upon atmospheric oxygen for oxidation, except by previous destructive distillation of that solid. This result was obtained by experiments with flour, resin, amber, and naphthalene, all of which caused violent explosions after distillation. But no explosion of charcoal or soot could be obtained, even when these substances were previously raised to a high temperature. He agreed that there must have been destructive distillation of the coal, free hydrogen in the educts, and dissociation of some of the hydrocarbons; but he thought that more of the hydrocarbons would be burned than Mr. Stuart supposed, and that the small quantities of carbon dioxide and carbon monoxide found in the mine must have been due to some dilution by subsequent access of air.

Several other members having taken part in the discussion,

Mr. STUART, in replying, dealt with the various difficulties raised. He explained the presence of oxygen in the stagnant atmosphere in the intervals between the explosion by drawing attention to certain phenomena which proved that the chemical changes—viz., the oxidation of the hydrogen of the educts—caused a partial vacuum, and the air in the irregularities of the roof and sides behind and above the timber, and in insterstitial spaces in the *débris* and side openings, made its way into the roads. Further, that the falls of roof were not air-tight, since in filling up the ways of the mine they left open space above; and in every case there was room for diffusion. In this way he suggested that oxygen was restored to the intervals between the disruptions, and allowed the candles to burn. This influx of air would dilute the gaseous products of the chemical changes, including the carbon dioxide and carbon monoxide; but the fact remained that the carbon of the gaseous hydrocarbons was not appreciably oxidized, as it was so thickly suspended in the air as to partly obscure the light at a short distance, and the side walls were heavily coated. There were also the facts that a man in the Malago Vale Colliery was, in one of the intervals between the disruptions, exposed to the gaseous products of the chemical changes, and was there several hours. He was rescued alive with his lamp burning in his hand. At the Albion Colliery, a man working between the *loci* of explosions immediately walked through the gaseous products for about 1000 yards, and was rescued. At the Tylorstown Colliery, three lamps were found burning beside a group of men, some of whom were dead; but one was alive, and was rescued. These three facts indicated that there was not 2 per cent. of carbon dioxide or 0·54 per cent. of carbon monoxide in the stagnant atmospheres immediately after the explosions, otherwise the lights must have been extinguished, and all the men poisoned. He pointed to the flame of a candle, of an oil-lamp, or of a coal-fire as evidence that distillation occurred in the presence of oxygen. As to the supposed impossibility of getting the educts of coal anywhere but in a gas-retort, he replied that heat was the agent that determined the distillation; and the educts of the coal in the retort and the coal in the ways of the mine must be identical at equal temperatures. The presence of oxygen simply affected the educts after distillation, and would cause subsequent changes, as put forward in the theory advanced. The suggestion made by Mr. Morgan, that the coal dust was swept up into the air and burned, and that the disruptions were due to fine coal dust, was confronted with the fact that the products of such action were carbon dioxide and monoxide in large volumes, which had been shown to have been absent. Further, at angles in the roads where such clouds of burning coal dust must have collided with the walls, there were no traces of the coke that in such conditions must have been deposited. Again the trams and timber forming obstructions in the path of the coal dust were covered with coked coal to a height of 12 inches above the floor—the deposit feathering off at a further height of 9 inches; and above that point the wood of both tram and timber was perfectly clean. The evidence was that distillation occurred in the coal upon the floor, and that particles of coal rose up the educts to 21 inches in height, and there was not a general cloud of coal dust and air filling the ways of the mine. He contended, upon the authority of Berthelot, the experience of every engineer using coal, and the experiments of Crampton and others in using fine coal dust in furnaces, that coal dust as a solid was not explosive; and that no explosion could be produced from it except with the gases obtained in destructive distillation. The nature of the roof and timbering in the fields of explosion had been carefully observed. Where the roof was of rock, an explosion could produce no more effect upon it than the ignited explosive upon the bore of a gun. But the materials at this point—viz., doors and trams—were shattered, and rails displaced, locating explosive violence. Where the roof was strongly bedded, and supported with occasional props, the road was found wrecked at intervals and undamaged in the intervening spaces—showing the exertion of explosive force at intervals; while the roof was of equal strength, and had identical supports throughout.

The PRESIDENT moved a cordial vote of thanks to Mr. Stuart for his paper and reply to the discussion.

Mr. STUART briefly acknowledged the vote; saying it had afforded him much pleasure to introduce the subject to the notice of the members.

SAFE AND UNSAFE OILS.

At the Meeting of the Manchester Section of the Society of Chemical Industry on the 4th inst., Dr. STEVENSON MACADAM read a paper on "Safe and Unsafe Oils for Lighting and Heating Purposes." The following abstract of the paper, and notes of the discussion which ensued, appeared in a recent issue of the "Chemical Trade Journal."

Dr. Macadam commenced with an interesting summary of the history of the use and testing of mineral oils for lighthouse illumination, and then proceeded to review the legislative restrictions and proposals that have been made from time to time in connection with the use of mineral oils for illuminating purposes. He pointed out that in 1870 he investigated and reported on mineral oils for lighthouse purposes; recommending 150° open test for the flash-point. Eventually, 120° close was settled on; and with such oil not a single accident had occurred in the northern lighthouses for the past twenty years. The first attempt at the regulation of the flash point of oils was made by the Government in 1862; and in the Act then passed, permission was given to search for oil flashing below 100° Fahr., in the same way as for gunpowder. Owing to the absence of definite instructions as to how to test the flash-point, errors and differences were constantly arising; so that in 1860, Messrs. Abel, Attfield, and Letheby agreed on a specific test of 100° Fahr., in an open cup, half full of oil, and heated by a water bath. This test, the author stated, had been found in practice to give results agreeing substantially with those obtained in Professor Abel's apparatus, which was subsequently introduced and is to-day the standard tester. Strange to say, however, within a week of drafting the schedule embodying this specified test (which was the conjoint production of the gentlemen named above), the directions for testing were cancelled; Sir J. Ferguson, who had charge of the Bill, explaining that he had done so on the advice of the Petroleum Association and Professor Abel. This advice was followed, despite the protests of the other experts who had co-operated in the formulation of the revised method. In 1876, the Abel tester was introduced (an excellent apparatus *per se*); and it was then contended that the difference between the old open test of 100° Fahr. and Abel's close test was 27°. The standard of safety was therefore reduced to 73° Fahr.; and it remains there to-day. Had the standard of 100° been adhered to, during the last ten years there would have been fewer fires from the employment of mineral oils, and many lives would have been saved.

The author then proceeded to review the work he had done in connection with his evidence given before the Parliamentary Committee which sat last session, and is to sit again. He very pointedly confirmed the testimony of Dr. Lobry Le Bruyn and others, that by removing 10 per cent. of the petroleum spirit with which American oil is charged, and which is also in Russian oils to a less extent, a uniformly reliable oil is obtained. These experiments were most carefully conducted, in order to avoid "cracking" in the distillation; and precisely similar results were obtained when superheated steam was used for distilling off the light spirit. By such treatment, it was shown that an American oil starting at 78° to 81° Fahr. flash-point, rose to 103° to 105° when 10 per cent. had been removed. A Russian oil of 81° to 83° rose to 104° to 106° Fahr. The possibility of finding a market for this light spirit when removed from burning oils was discussed; several existing outlets—such as for dry cleaning and as a source of power for motor cars—being indicated.

Having established the commercial practicability for thus rendering lamp oils safe, the next point was the influence (if any) on the lighting power. Direct experiment showed there was practically no change. In the course of a very exhaustive series of trials on the lighting power and other properties of mineral oil for lighthouses, the author had found it best to express the total light in pounds of sperm per gallon of oil; and on this basis ordinary low-flashing American oil gave 19·85 lbs. per gallon and 19·71 lbs. per gallon when treated. At the same time, the steadiness and so forth of the flame was unaffected; and the wicks, if anything, stood better. Another point which had been very clearly brought out was that, by removing 10 per cent. of the light spirit, it was entirely erroneous to contend that a corresponding 10 per cent. of the heavy end of the oil had to be likewise removed. Such was not the case at all. With regard to the removal of the light spirit, it should be noted that, by heating the oil to 80° Fahr. in a water-bath, and aspirating air, a kind of air-gas was obtained, and when only 7 per cent. had been vaporized, the flash-point rose from 78° Fahr., or thereabouts, to 104°. It was a most important fact that, by mere exposure in an open vessel at the ordinary temperature (about 60° Fahr.), the light spirit evaporated quickly. In three days 5·7 per cent. was lost, and the flash-point rose from 81° to 102°. In nine days, as much as 26 per cent. of the total bulk evaporated. Similar results were not attainable with high-flashing oils.

Touching the cost of treatment, it could not exceed ¼d. per

gallon; and this could only be counted an extra expense provided there was no outlet for the petroleum spirit *per se*. There was no actual additional cost in the distillation, as it was only a case of turning the first runnings into the naphtha-tanks for a few minutes longer than it was customary to do now.

Coming to the question of lamps, a number of experiments were described; and the results obtained with lamps costing from 6d. to 10s. each were related. Dr. Macadam made special allusion to the temperatures which the oils in the founts of many lamps attained during an evening's burning; and he showed that an oil having a flash-point less than 100° Fahr. was at all times dangerously near the exploding-point. He submitted that there was really no reason for the employment of such dangerous oils as were now sanctioned in this country; and a return to the proper limit of 100° would ensure the public safety being cared for, while the quality of the oil would be improved. With regard to the lamps now in use, the author expressed the opinion that many of them, even some of the higher class lamps, were faulty in construction; and he made a number of suggestions for the better construction of lamps of even the cheapest forms. He also dwelt on the time taken to ignite with a taper a piece of cloth saturated with high-flashing oil, as compared with a piece saturated with an equal quantity of low-flashing American or other oil, which ignited at once.

To summarize his paper, Dr. Macadam contended that oils flashing below 100° Fahr. were not safe for public use. He was decidedly of opinion that this standard should be restored by law, and that all oils should be labelled as of such and such a flashing-point. Oils below 100° he would have labelled "Mineral spirit, but not safe for house-lamps."

The Chairman (Dr. Schunck), having made a few appreciative remarks on the paper, moved that a vote of thanks should be accorded to the author.

Mr. G. E. Davis seconded the motion. He supported Dr. Macadam in his experience of igniting high and low flash oils on cloth or blanket. He described an actual experience, tending to show that retailers are liable to mix up benzoline and petroleum when serving customers. In the case of a sample drawn from two cans, the flash-point was found to be 62° or 63° Fahr. A check sample, drawn from one can only, tested 82° Fahr. Oil so sold to ordinary consumers would most likely have led to an accident. Another thing that had occurred to him was this: When the contents of a tank steamer were being pumped into the empty storage reservoirs, what became of the displaced air which was saturated with the vapour of petroleum spirit? As far as he knew, no provision was ever made for dealing with it. There was little doubt that, owing to the want of a better market for the petroleum spirit, the Americans left as much of it as possible in certain grades of oil, which they got rid of to their neighbours. He looked, however, to the ordinary course of trade and motor cars to remedy this.

Dr. Angel referred to the experiments on lamps made by the London County Council and the "Lancet."

Mr. E. Powell asked for information as to the meaning of the brand of 120° test, which was on the barrels of ordinary American petroleum sent in to this country.

Other remarks having been made on the paper,

Dr. Macadam, in reply, said he was glad to find Mr. Davis could corroborate his experiments. With regard to the London County Council form of lamp, he was in the same position as Dr. Angel—namely, he could not understand how the lamp failed to cause an accident. In answer to another speaker, he explained more fully the dry cleaning process. The gravity of the spirit was 0·752 for American and 0·785 for Russian. He could not say whether or not it left an oily residue. As to the outlet for this spirit, he knew one firm of cleaners who recovered all they could, and yet wanted 40,000 gallons a year to make up the unavoidable loss by evaporation. He could not explain the 120° brand. It was another point which could not be understood.

The motion was carried, and the meeting terminated.

THE BACTERIAL PURIFICATION OF WATER.

This was the subject of a paper read, on the 24th ult., before the Institution of Civil Engineers, by Dr. Percy Frankland, F.R.S., Professor of Chemistry and Metallurgy at the Mason College, Birmingham.

The author dealt with the more important advances in the subject since he brought it before the Institution ten years ago. In the consideration of bacterial purification by natural processes, the so-called "self-purification" of river-water was discussed in so far as the spontaneous disappearance of bacteria in running water was concerned. Several special instances of stream purification were referred to; and the relative importance of the factors concerned in the process—such as sedimentation, action of light, algæ and chemical oxidation, temperature and movement—was taken into account. The removal of bacteria during the natural filtration of water through porous strata was exemplified by the contrast, as regards bacterial contents, exhibited between surface and deep-well waters.

The latter part of the paper was devoted to bacterial purification by artificial processes; and under this head the purification of public water supplies by means of sand filtration was considered. In the first place, the importance of a preliminary purification of the unfiltered water by storage in reservoirs was pointed out. Not only did the coarser particles in suspension become deposited during storage, but a large number of the bacteria present also succumbed to sedimentation. This important fact had been first demonstrated by the author in 1885, in the course of numerous experiments he had made on the removal of micro-organisms from water. More recently he had studied the bacterial value of sedimentation on a practical scale at the reservoirs of the London Companies. The rate at which sand filtration was carried on was then discussed; and the practice in this respect at several of the more important water-works was indicated. The necessity of slow and uniform filtration was insisted upon if satisfactory results were to be secured. The depth of the fine sand to be employed in filters was then discussed; and experiments were cited showing the advantages to be derived from the use of a thick layer of the material. Attention was also directed to the size of the sand-grains employed, and the effect of this factor upon the bacterial quality of the filtrate; and the results of mechanical analyses of sands derived from filter-works in different parts of Europe were given. The filtering power of the surface layer of slime was referred to; and its incapacity, if unaided, of yielding a satisfactory filtrate was pointed out—experiments being quoted to show the further removal of bacteria in the subjacent layers of fine sand. The effect on the quality of the filtrate of cleaning the filters, was pointed out.

After referring to experiments made in America on the intermittent filtration of potable water through sand, and to actual practice at the Chemnitz Water-Works, in Germany, the author drew attention to the grave disturbances in the efficiency of sand filtration which he had found to occur occasionally in frosty weather. The results of the author's past examination of the London Water Supply for the Local Government Board were shown in a diagram, in which the marked rise in the bacterial contents of the filtered water strikingly corresponded with the fall in the temperature to the vicinity of freezing-point. The difficulty of guarding against the deterioration of the effluent during such times, was one of the principal problems which engineers had to face in this country, where it was not customary to cover the filter-beds. The importance of guarding against these disturbances—occurring as they did just when surface-waters were generally in their worst condition, and stood most in need of efficient filtration—was strongly emphasized.

The author reproduced, in an appendix, the regulations issued by the German Government in regard to the filtration of surface waters used for public water supplies, showing how far behindhand was English practice in submitting the purification of the public water supplies to the systematic control of bacteriological examination.

The discussion on the paper was opened, and adjourned until Tuesday, the 1st inst. A number of speakers took part therein, including Dr. Anderson, Mr. Baldwin Latham, Mr. W. J. Dibdin, and Dr. Dupré; their remarks being mainly directed to a consideration of the value of the bacteriological as opposed to the chemical examination of water, and of the degree of security conferred by sand filtration as a process of purification.

Dr. Percy Frankland, in his reply, pointed out that a very serious misapprehension was prevalent in the supposition that a large number of bacteria in potable water was *ipso facto* objectionable. He had shown many years ago how, on keeping a deep-well water of most unimpeachable quality, it became in a few days peopled by hundreds of thousands of bacteria in a cubic centimetre, and yet nobody would venture to assert that the water was any the worse for their presence. He thought this misunderstanding about the mere number of bacteria was largely due to Dr. Koch having made the statement many years ago, when the bacteriology of water was quite in its infancy, that "good water" should not contain more than about 100 bacteria per cubic centimetre. It had, however, soon been found that this was quite untenable. Dr. Frankland indicated how there might be actual safety in the presence of a large number of bacteria. He had himself introduced typhoid bacilli into deep-well water which was almost wholly free from bacteria, into Thames water which contained a large number, and into Loch Katrine water in which the number was intermediate between the two. He found that the typhoid bacilli died off more rapidly in Thames than in Loch Katrine water; while they persisted longest in the sparsely-populated deep-well water. Thus the longevity of these pathogenic bacteria was inversely proportional to the bacterial population in the waters into which they were introduced. With reference to the supposed antagonism between the chemical and the bacteriological examination of water for hygienic purposes, he pointed out that, while the general quality of a water could undoubtedly be most satisfactorily ascertained by chemical analysis and an inspection of the source, the efficiency of a particular purification process could only be determined by the bacteriological examination of the water before and after undergoing the process in question. It was in this direction that the numerical determination of bacteria had given such valuable information, by indicating the factors upon which the process of purification was dependent, and by showing how increased efficiency might be attained by due attention being paid to those which were of importance. The bacteriological examination of water was, in fact, the only referee in adjudicating upon the efficiency of methods of water purification for drinking purposes.

REGISTER OF PATENTS.

Bye-Pass Gas-Burners.—Peterson, M., of Stockholm. No. 22,811; Nov. 28, 1895.

This invention has for its object to diminish the supply of gas to the pilot jet or auxiliary flame of a gas-burner, when the gas issuing from the main burner is lighted. To this end, the gas-conduit to the auxiliary burner is provided with a cock or valve, combined with the ordinary cock in such a manner that the former is almost shut when opening the ordinary cock, and is opened to its normal size when closing the ordinary cock. The ordinary cock is lengthened, and provided with an additional passage opening into the common gas supply and into the conduit leading to the auxiliary burner; the passage being arranged in the plug in relation to the main passage for the ordinary burner in such a manner that, in operating the cock in the usual way, the above-mentioned object is attained.

Bodies for Use in Incandescent Gas Lighting.—Barrière, P., of Paris. No. 24,008; Dec. 14, 1895.

Several references have been made in the "JOURNAL" of late to a so-called new element termed "Lucium." This alleged "novel illuminating body" is that alluded to as "A" in the following abstract of the specification of the above-named patent:—

The inventor remarks that, numerous experiments have enabled him to discover the presence of a novel illuminating body (referred to under the letter "A") in a special ore of a sandy nature, obtainable at different places and known as monazited sand. The ore, which possesses a sandy appearance, is really rich river loam, found in small ruby-like pebbles. The following is an analysis of the substance:—

Silica (SiO_2)	69·70 per cent.
Phosphoric acid (P_2O_5)	6·00 ,,
Iron (Fe_2O_3)	1·92 ,,
Alumina (Al_2O_3)	15·00 ,,
Cerium, lanthanium, didymium (about)	2.13 ,,
Moisture	2·05 ,,
Lime, magnesia, and other miscellaneous matter (about)	2·00 ,,
"A" body	1·80 ,,

The new body "A" enters into the composition of the ores named in the proportion of from 1·5 to 6 per cent., according to the sample dealt with.

The ore, on having been porphyrized, is slowly melted in suitable furnaces, with an addition of carbonate of sodium in the proportion of one part of ore for every two parts of carbonate. This operation, which takes about three hours to complete, is intended to convert the oxides into insoluble carbonates. After cooling, the powdered mass is lixiviated; and then, by means of decantation, the elimination of the silicates and phosphates of sodium is proceeded with. When the carbonates are exhausted by the water, they are subjected to the action of sulphuric acid, the surplus of which is eliminated by slow calcination. The sulphates are dissolved in cold water and precipitated by means of ammonia. The precipitate, on being washed, is dissolved in hydrochloric acid—care being taken to properly neutralize it. The greater part of the iron and alumina is then removed, by precipitating it by oxalic acid. The insoluble oxalates are converted into sulphates; and then partial calcination in a muffle-furnace is proceeded with.

The calcination is interrupted at a certain period of the operation, determined by taking into account the appearance of the material under treatment; the proper time being when the greater part of the acid has been eliminated. The sulphates obtained are then pulverized, and put in cold water in small quantities, so that the saturation stage is as nearly as possible reached. The solution obtained is then precipitated by means of ammonia, whereby magnesia and the salts of lime are eliminated. Then, by filtering, a gelatinous precipitate of oxides is obtained, which is dissolved in sulphuric acid.

The sulphuric solution obtained, having had sulphate of sodium in solution (saturated while cold) added to it, is used as a precipitating medium; there being crystals in suspension in the mass, and the saturated solution being allowed to digest for from five to six hours. Thus the group cerium, lanthanium, didymium is precipitated. The double sulphates thus obtained are filtered; and the liquid is re-precipitated by means of ammonia, and then thoroughly washed. In order to remove thorium, the solution is made in sulphuric acid, and the precipitate obtained by means of sulphate of potassium. Thus all the bodies mentioned above as being present with the "A" body may be eliminated.

Now the principal operation of the process has to be commenced. It consists in precipitating the solution by means of hyposulphite of sodium in the condition of a concentrated solution. This operation is started with a slight action of heat. When the boiling-point is reached, the "A" body is precipitated first. The body obtained contains, as impurities, small quantities of yttrite earths—principally ytterbine. It only remains, after this, to effect a most thorough washing of the insoluble hyposulphite thus obtained; using cold water for the purpose. After the washing, a solution is made in hydrochloric acid. A reaction with sulphocyanide of ammonia will at that moment show whether there are any traces of iron left; and these, if present, are eliminated by the ordinary methods. In the same way, traces of other metallic substances may be eliminated by means of a current of sulphuretted hydrogen sent into the solution of hydrochloric acid.

After precipitation by means of ammonia, the body is energetically washed with distilled cold water; and in this way, a body is obtained which, in itself, is luminous, and which is made use of in the manner the patentee proceeds to describe. Generally speaking, the oxides employed for illuminating purposes, as well as the body just referred to, produce light which is illuminating and radiating only to a certain degree. Radiation (which constitutes the illuminating power proper, and more particularly the brilliancy desirable in a luminous body) is obtained owing to the molecular condition found to be realizable with exceptional ease in a body which, after many trials, he has discovered to be oxide of zinc. This, being heated at an ordinary temperature assumes a greenish-yellow hue; but, when subjected to the heat of a bunsen burner, it becomes phosphorescent, as it were. It is sufficient to add a small percentage of a nitric solution of the oxide to the illuminating solution.

After a fabric, as fibrous as possible, has been impregnated with the solution, and the wick thus formed has been incinerated, the decomposition of the nitrates will take place under the most favourable conditions conceivable. Part of the oxide of zinc (the surplus) is volatilized, while the remainder will be in the molecular condition just referred to. The fabric employed is made of special thread or filament—such as the fibres of flax, China grass, or the like—and it should have about 90 meshes per square centimetre. It is washed in a one-tenth solution of hydrochloric acid, and then with water having a slight amount of ammonia incorporated in it. The fabric, after drying, is cut into strips of (say) 20 centimetres, and strengthened at their upper part with a strip of muslin or tulle. Impregnation may be advantageously substituted by aspersion; and it offers the advantage of not necessitating protracted handling of the fabric, whereby certain impurities might find their way into it.

The bath employed is a nitric aqueous solution, containing as much as 10 per cent. of the luminous body; and each wick should absorb at least 6 cubic centimetres. After the wick has been placed on a special form or mould, it is secured to a hanger of nickel by means of an asbestos thread. A bunsen flame is then rapidly and circularly passed round the upper portion of the wick; while another burner is worked from below. Incineration thus takes place, and the earths form gradually. By these means, "a species of skeleton is obtained, which is placed over a burner for about half an hour, in order to secure complete calcination." The wick is then in readiness for the market, and may (says the patentee) be fitted to any burner.

Coin-Freed Apparatus for the Sale of Gas.—Glover, R. T. & J. G., of St. John Street, Clerkenwell. No. 24,996; Dec. 31, 1895.

Fig. 1 is a sectional elevation of the upper or gear chamber of a gas-meter. Fig. 2 is an edge view of the gear. Fig. 3 is a plan of the gear chamber (with the cover removed), with the gear for opening the valve after the receipt of a coin, and of gear for closing the valve by the meter mechanism. Fig. 4 is a reverse side elevation of the gear, with part of the frame broken away to show the connection of the pinions with the wheels.

Fig. 1.

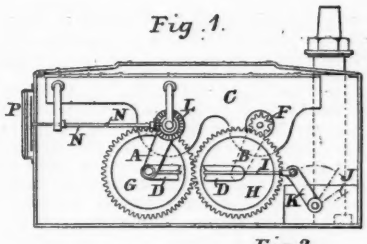


Fig. 2

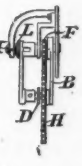


Fig. 3.

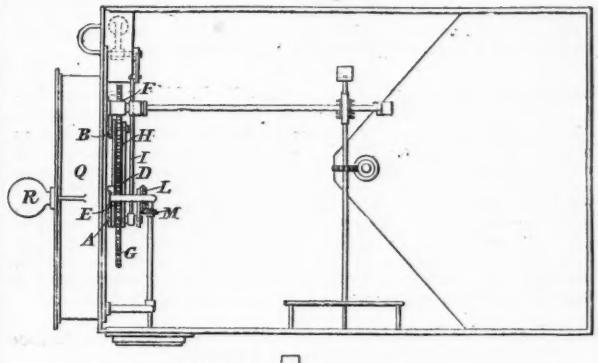
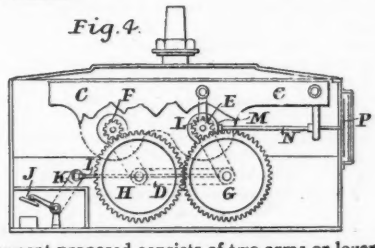


Fig. 4.



The arrangement proposed consists of two arms or levers A B, each pivoted at one end to a plate C, and the other ends connected by a bar or link D. One of the pivots (say, A) in the plate can be attached to coin-actuating apparatus of any kind; and the other (say, B), to the meter mechanism. The motions obtained therefrom cause the link or bar D to move in a parallel manner by the following arrangement: A wheel or pinion E F is fixed at each pivot, around which the arms or levers A B can move freely; and these pinions gear into two wheels G H, pivoted to the opposite or free ends of the levers or bars A B. These wheels are of such diameter that they also gear into each other, as indicated; so that when either pinion is turned, it rotates the wheel G or H, and by this means causes the wheel to communicate motion to the other wheel, and each to travel around its own pinion, and thereby pushing the connecting link D along so as to obtain a motion for opening or closing a valve, or for any other required purpose.

A valve-rod I is preferably attached to the farther lever (such as A) from the valve J, which lever may operate direct or through a crank or other arm—say, that marked K. One pivot (say, that with the lever A) may have a pinion or mitre wheel L on it, for gearing into the pinion M, which, by the spindle N, can turn the indicator finger P to show on its dial the quantity of gas left to be consumed at any time, supposing a number of coins had been placed in the slot of the coin-receiving apparatus which for the time forms part of the meter.

In fig. 3 is shown the coin-receiver described in patent No. 25,272 of 1894; but the present invention is applicable to any system of coin-receiving apparatus direct or by a slight modification of the attachment appliances.

By reference more particularly to fig. 1, it will be understood that for each predetermined coin inserted in the casing Q, the handle or knob R is rotated a defined arc of a circle, in accordance with the quantity of gas allowed as value for each coin. This handle moves (by the coin's contact with the mechanism in the casing) the shaft axially arranged therewith. This then turns the pinion E under gear wheel L and spindle N; and the finger P indicates the movement for the satisfaction of the consumer. The pinion E simultaneously—by being in gear with the wheel G—causes it to move round; and this being in gear with the wheel H, the wheel is rotated also to a corresponding distance. Both of them move round their respective pinions; and their connection with the link D causes their centres to maintain a parallel position. By this means, at each turn of the handle with a coin in the gear casing, the pinion E turns the wheel G, and in so turning rotates the wheel H, which, though in gear with the pinion F, only walks round it without imparting any rotatory motion thereto—the pinion F being operative only during the consumption of gas.

During the motion before mentioned, from the fact that the wheels G H are pivoted to the free ends of the levers A B only, it follows that the levers by the link connection D are likewise moved; and by the attachment of the rod I, the valve J is opened for the flow of gas into the meter from the main. So soon as consumption commences, the meter mechanism causes the pinion F to turn; and this allows the wheel G to walk round without imparting any motion to it—the movement of the wheels G H by the locked position of the pinion causing the link D to travel, and with it the rod I, and so close the valve J. This happens, however, only gradually.

Wood Grids for Gas-Purifiers.—Hawley, J., of Penistone. No. 1351; Jan. 20, 1896.

To secure the parts of gas-purifier grids together, the patentee proposes to bore a hole of equal diameter entirely through the sides, the grid-bars, and the distance blocks between the bars, and prepare a wood or metal rod or pin to fit the hole. If the pin is of wood, it is made of larger diameter than if of metal, and by preference of hickory, or other tough wood. The sides are also prepared with small holes passing into the larger holes transversely. When the various parts are put together, and the wood pins are forced into position, the grid is subjected to the action of cramping jaws, to bring all the joints tightly in contact; and short wire pins (or chisel-ended cotters) are driven down the small transverse holes through the wood pins, and into the lower part of the side pieces. The pin or cotter expands the wood pin in passing through it, and causes it to fill and bind very tightly in the hole. When metal pins or rods are used, a hole is made through each end for the short pins or cotters to pass through; or if preferred, they may have a neck formed upon them, and (instead of a pin or cotter) a staple may be used to pass over the neck.

Incandescent Gas Lighting.—Wilsmore, N. T. M.; a communication from D. Little, of Melbourne. No. 1521; Jan. 22, 1896.

The patentee proposes "to prepare in slender particles or fibres, or to file or pound or grind into fine grains or powder, or otherwise to procure minute subdivision, any earths or minerals or other substances or chemical preparations, or combinations of such earths or minerals or other substances, as may be capable of easily incandescing or glowing under the action of heat." These he suggests mixing with, or spreading over and pressing into, or affixing on, or enclosing in, or otherwise incorporating with, the substance of the glass chimneys. The result claimed is that they will "become incandescent, or emit a glow of light when heated by the flame of an ordinary gas-burner."

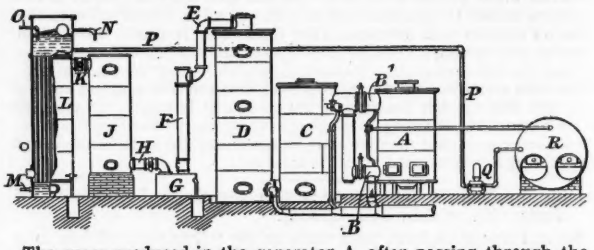
Pilot Lights for Incandescent Gas-Burners.—Talbot, H., of 709, Old Kent Road, S.E. No. 1810; Jan. 25, 1896.

This invention relates more particularly to incandescent gas-lamps used for out-door lighting; and it consists in means for turning out the pilot when the main burner is alight. The pilot light is placed externally of the mantle; and the tap or cock of the pilot light is so arranged that, when the main supply is on, the pilot is out, and *vice versâ*. For this purpose, the main supply-cock is provided with a lever (by which the lamplighter may turn the gas on and off with his torch), supplied with a pin which works in a slot of, and operates, an arm on the cock of the pilot light, so that the latter may be turned off when the main supply is on, and turned on when the main supply is off.

Heating Boiler Feed-Water from a Water-Gas Plant.—Glasgow, A. G., of Victoria Street, S.W. No. 2183; Jan. 30, 1896.

When manufacturing water gas, the patentee proposes to cool the gas in a surface condenser by water that can be subsequently used in a steam-boiler connected up as shown in the engraving, which is a water-gas apparatus of familiar type.

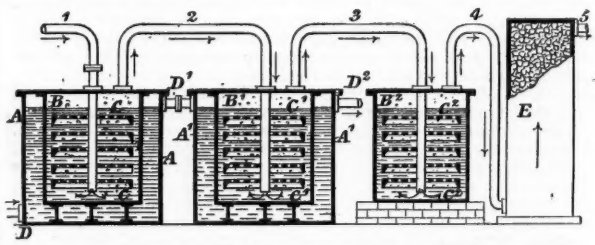
A is the generator, having gas take-off pipes B and B^1. C is the carburetting chamber. D is the fixing chamber. E is the pipe for conveying the water gas to the washer F, whence it passes through the seal-box G and pipe H to the scrubber J, and thence through the pipe K to the surface condenser L, on its way to the receiver apparatus and mains. The condenser is of the usual construction; but at the ends of the portion through which the gases pass, it has heads connected by tubes extending from the water receiving chamber to the water delivery chamber, which serves as the receptacle from which the boiler draws its feed-water. M indicates the pipe through which water is forced into the condenser. N is the overflow-pipe, by which water can escape when it exceeds a determined height. O is an auxiliary or supplemental supply-pipe, fitted with a cock or valve, arranged to be opened and closed by a float in accordance with the height of water in the receptacle. P is the water supply-pipe which leads to the feed-water pump Q; and there is also a pipe for conducting the feed-water from the pump to the boiler R.



The gases produced in the generator A, after passing through the carburetting and fixing or superheating chambers, and through the washer and scrubber, flow through the surface condenser L, and are cooled by the water forced upward through the tubes. The heated water from the tubes passes into a receptacle conveniently placed, as shown, upon the top of the condenser. From this, the pump Q draws feed-water for the boiler through the pipe P; and in case the supply of water entering the receptacle is too much, the excess escapes through the pipe N. If, however, the supply is not sufficient to feed the boiler, the falling of the level of the water in the receptacle will lower the float, and permit additional water to flow from the pipe O into the receptacle until the normal height of water is insured therein.

Purification of Acetylene.—Pictet, R. P., of Geneva. No. 18,208; Aug. 17, 1896. Date claimed under International Convention, Jan. 25, 1896.

The patentee, in his specification points out that acetylene gas formed by the action of water on calcium carbide, or "carbite," contains a number of impurities whose action is very injurious. Ammonia hydrogen, sulphuretted, arseniuretted, and carburetted hydrogen, and carbonic oxide are found in varying proportions in acetylene, according to the nature of the materials employed in the electric furnaces for the manufacture of the calcium carbide. These impurities give to the acetylene special characteristics. Impure acetylene attacks nearly all common metals (specially copper), forming with these bodies compounds of which some are detonating; and the illuminating power of the gas is diminished by the presence of these impurities. Impure acetylene burns with a flame surrounded with a purple halo, which is only slightly luminous; but this halo disappears when the acetylene is pure.



In the specification of another patent of even date with the present one, the inventor has described a method of manufacturing acetylene which produces the gas in an "already high state of purity." In order to obtain complete purification, he prefers to start with gas made by his new process; but he can also apply his process of purification, as described below, to acetylene obtained by any other process. The process consists in: (1) Making the gas bubble through a concentrated solution of calcium chloride, cooled down to a temperature between − 20° and − 40° C. (2) Passing the gas through a solution of sulphuric acid of about 40 per cent. concentration, cooled down to a temperature between − 20° and − 60° C. (3) Washing the gas with a solution of lead salts at the ordinary temperature. (4.) Drying the gas by passing it over crystallized calcium chloride, to complete the purification.

Alluding to the process thus sketched out, the patentee says: Chloride of calcium acts like a sponge for all the impurities of acetylene of which it removes especially the most dangerous—ammonia and its derivatives; and if the gas is split up into very small bubbles, all traces of ammonia and water vapour disappear. As is well known, chemical reactions entirely cease at low temperatures; and there is a selective order in which the reactions progressively diminish. The action of sulphuric acid on acetylene ceases almost completely at − 20° C. It is therefore possible to take solutions of sulphuric acid and water which is still liquid at temperatures below − 20° C., and only solidifying towards − 70° or − 80° C., through which to bubble the acetylene in order to fix physically and chemically the impurities whose point of reaction with sulphuric acid is lower on the scale of temperatures than that of pure acetylene.

In the engraving, A A^1 are vats, in which the circulation of some refrigerating liquid is set up. B B^1 B^2 are vats, the first two supported on girders in the vats A A^1, and being surrounded with the refrigerating liquid. Vertical pipes conduct the acetylene to the bottom of the vats. C C^1 C^2 are flanged plates pierced with holes, so as to divide up the gas and obtain intimate contact with the solutions. D is a pipe for the entrance of the refrigerating liquid; D^1, a pipe by which it passes from vat A to vat A^1; and D^2, the exit-pipe. E is a column containing crystallized calcium chloride. 1, 2, 3, 4, 5 are pipes for conducting the gas.

The acetylene to be purified is delivered at the bottom of the vat B,

which contains a solution of calcium chloride kept at the desired temperature above — 40° C. The gas, after having traversed the solution by passing up through the holes pierced in the plates C, is led to the bottom of the vat B^1 containing the solution of sulphuric acid at a low temperature. It then rises in this vat through the holes in the plates C^1, and arrives at the bottom of the vat B^2, which contains a solution of lead salts at the normal temperature. The acetylene traverses this solution, passing through the holes in the plates C^2; and enters the pipe 4, by which it arrives at the bottom of the column E. The purification of the gas is completed while it is rising in this column over the crystallized calcium chloride; and it is then conducted by the pipe 5 to a holder.

Treating Calcium Carbide to form a Uniform Composition for Use in Generating Acetylene Gas.—Deuther, J. A., of Boston, U.S.A. No. 20,598; Sept. 17, 1896.

The object of the patentee is to prepare a uniform mixture of carbide of calcium and some inert substance, so as to retard the production of acetylene gas on water being brought into contact with the mass. The binding material may be either a solid or a liquid; and it would be mixed with the finely-divided product so that, when compressed into tablets, it would be "more coherent, and retain its tablet form." Having obtained a mass of uniform composition, each tablet would represent by decomposition a definite amount of gas, when brought into contact with water. In another application, filed simultaneously with the present one—see "JOURNAL," Nov. 17, p. 971—the patentee has shown an apparatus in which a fixed amount of calcium carbide or analogous substance, preferably in tablet form, is fed to the gas-generating chamber containing either water or other liquid, and the feeding of the calcium carbide is automatically controlled by the pressure or volume of gas generated.

Regulating the Supply of Gas to Water-Heating Apparatus.—Braithwaite, C. L., and O'Brien, E., of Kendal. No. 21,689; Sept. 30, 1896.

This invention consists in the application to a gas-heater of a gas-controlling valve, so attached that two different pressures are maintained as the water is being drawn, and which will open and close as the water-outlet or service-tap is turned on or off. The valve is constructed with two water-chambers, connected respectively to the water system of the apparatus at either side of a check-valve or other pressure-reducing device; the chambers being separated by a corrugated rubber or other flexible membrane carrying a plate or diaphragm, to which is attached a rod or spindle carrying a valve, which opens and closes the gas-passage.

Gas-Stoves.—Imray, O.; a communication from V. W. Blanchard and E. K. Stow, of New York. No. 22,153; Oct. 6, 1896.

This invention has for its object "to effect perfect combustion by consuming with gas large volumes of air, which is heated in the apparatus before its admixture with the gas, and is introduced into the burning gaseous mixture in small quantities at successive points."

Fig. 1.

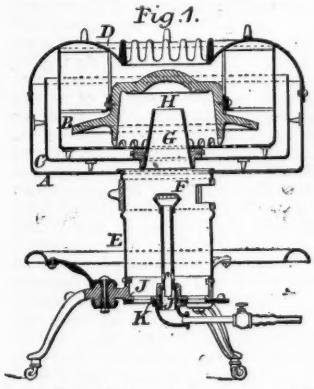


Fig. 2.

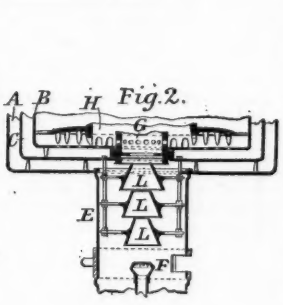


Fig. 1 illustrates apparatus especially adapted for heating stoves by combustion of illuminating gas. Fig. 2 illustrates means of mingling the gas with air before or after its ignition, but before it enters the combustion chambers of the apparatus.

A B C designate three pan-shaped casings, placed one within the other, and separated by air-spaces which communicate over the edge of the pan C, under the cover D, which fits on both pans A and C, and has a central opening. Pan A has a central opening in its bottom, fitted on the upper end of a cylinder E, within which is a burner F. A tube G is fitted in the openings in the bottoms of the pans B C, directly above the burner F, so as to conduct flame from the burner into a dome H, placed in the cup B over the tube G, and forming a pocket to retard combustion gases. The dome has gas-exit passages in its lower edge, above which (on the outer side of the dome) is a lateral flange that extends nearly to the sides of the cup B, so as to direct the heated products of combustion against the sides. In fig. 1, the dome H has a central concavity in its ceiling, surrounded by shallow annular concavities for the purpose of retarding the lighter gases. The flange is also slightly concaved for the same purpose.

In fig. 2 is shown a series of gas and air mingling taper tubes L, arranged one above the other within the cylinder E above the burner F. By this arrangement, a gaseous current under pressure entering the lowest tube, and traversing them successively, causes portions of air in the cylinder E to enter at the points where one tube discharges into the other. The tubes are gradually increased in size, from below upwards. When the gas is very rich in carbon, it may be desirable to pass it through tubes L.

The apparatus operates as follows: Gas on entering is mixed with air, and the mixture is fired at the burner F. The heated products then pass through the tube G into the dome H, drawing up air through the cylinder E; part of the air entering the tube G with the gases, and part flowing into the air-passages at the side to be heated. As the gases descend in the dome outside the tube G, they are mixed with jets of hot air entering through the perforations; and as they pass in a thin layer outwards from the dome under the flange, they are successively mixed with jets of air so that the combustible portions are burned. The thin layer of burning gases, after passing outwards under the flange and becoming commingled with the jets of highly heated air, which increase the temperature of the layer, is directed against the wall of the pan B, thereby raising to a very high temperature the current of air descending the inner side space, and rendering it fit to act effectively in promoting combustion. The process of combustion is thus progressive in character; heated air being added to the burning gases in minute jets at intervals, and heat developed by their combustion before another addition of air. The cooling of the combustible gases is in this way avoided; and their temperature is constantly increased.

The apparatus, says the patentee, is so designed that the currents of burning gases and heated air "are constantly changing or reversing their direction of movement, and expanded and contracted, distributed and commingled, so that the whole internal structure is raised to an intensely heated condition, and combustion is so complete that no odours are produced. In practice, from 30 to 50 cubic feet of air can be mingled and consumed with 1 cubic foot of gas; while the dome and internal parts are maintained at such a high temperature that complete combustion of the gaseous elements is realized; there being always a supply of oxygen present in the burning gases to effect combustion of their combustible ingredients."

APPLICATIONS FOR LETTERS PATENT.

28,523.—DUTTON, E. K., "Gas and other motors." Dec. 14.
28,527.—MACKENZIE, J., and CARLING, J., "Gas or oil motors." Dec. 14.
28,575.—SHARP, W., "Improvements in globes, chimneys, and the like." Dec. 14.
28,588.—MOND, L., "Improvements relating to the production of a mixture of air and water vapour for gas-producers." Dec. 14.
28,603.—JENSEN, P., "Glass for incandescent gas-lamps." A communication from C. Kipper. Dec. 14.
28,631.—HUMPAGE, T., and JACQUES, H. I., "Gas and oil engines." Dec. 15.
28,646.—DAGNALL, E., "Internal combustion engines." Dec. 15.
28,718.—HENNESSY, T., "Gas-generators." Dec. 15.
28,722.—BEAN, H. R., and RINGWOOD, H., "Generators and holders for acetylene and other gases." Dec. 15.
28,725.—WEBBER, W., "Prepayment meters." Dec. 15.
28,745.—CARTER, J. W., and GOETZE, O., "Gas-heater." Dec. 15.
28,757.—WINGFIELD, W., "Improved device to be attached between a gas-meter and the main." Dec. 15.
28,768.—CANELLOPOULOS, J., and KRATZ-BOUSSAC, H. O., "Igniting devices for gas-burners." Dec. 15.
28,776.—SMITH, A. G. & A. J., "A floating acetylene gas generator." Dec. 16.
28,828.—COWAN, W. & W. H., "Prepayment gas-meters." Dec. 16.
28,837.—PATERSON, R. M., "Gas-engines." Dec. 16.
28,842.—CULVER, F. E., "Gas-engines." Dec. 16.
28,892.—WOOD, C., "Valve gear for gas and oil engines." Dec. 16.
28,960.—TOURTEL, J., and THE TOURTEL GAS AND GENERAL ENGINEERING COMPANY, LTD., "Coin-freed prepayment meters." Dec. 17.
28,979.—ROSER, N., and MAZURIER, J., "Gas motors." Dec. 17.
29,005.—RICHARDS, S. L., "Gas or oil stoves." Dec. 17.
29,053.—LOFTUS, A. J. (Count Nehtate), "Lamps or lanterns." Dec. 18.
29,057.—EDWARDS, J., "Treating the mantles of incandescent gas-burners to render them more refractory." Dec. 18.
29,067.—TURNER, E., "Silent condenser for gas-engines." Dec. 18.
29,076.—DUKE, J. F., "Automatically igniting gas." Dec. 18.
29,101.—MAXIM, H., "Gas-engines." Dec. 18.
29,168.—RICHARD-LAGERIE, E., "Producing acetylene gas." Dec. 19.
29,175.—BOLLMANN, L., and KOHNBERGER, S., "Turbines driven by steam or gas." Dec. 19.
29,178.—ROBINSON, C. T., and PRESCOTT, S. J., "Atmospheric gas-burner." Dec. 19.
29,188.—THOMPSON, W. P., "Producing acetylene gas." A communication from L. L. H. Gérard. Dec. 19.

The Fylde Water Question.—Meetings of the ratepayers of Blackpool and Fleetwood have been held on the subject of the proposed acquisition of the undertaking of the Fylde Water Company by the Local Authorities of the district. In both cases sanction was given to the scheme which has been formulated; but a poll was demanded. The expense of this is perhaps excusable in the case of Blackpool, where those who voted against the scheme numbered 24, as compared with 70 in its favour, and where complaint was made of inadequate notice of the meeting. But at Fleetwood there was only one dissentient to the scheme. The ratepayers of Kirkham have rejected the scheme by 28 votes to 8; at St. Anne's-on-the-Sea, the voting was even; and at Lytham, the purchase was agreed to by a majority of six. In each case a poll was demanded.

The New Water-Works of the Bradford Corporation.—The construction of the Gouthwaite compensation reservoir of the Bradford Corporation is making satisfactory progress. The gauge basin beyond the great dam, and the training walls for conducting the river thence to its ordinary course, are practically completed; and early next year the Nidd, which has already been diverted from its original course from one side of the embankment to the other, will be led through the culverts in the dam, and the dam can then be continued on the side where the river now runs. It is expected that the whole of the work at Gouthwaite will be finished in about three years. By the time the huge stone embankment, blocking up the end of the valley, and through which the stream and water stored will run in measured quantities, is completed, the chief undertaking in connection with the formation of the reservoir will have been accomplished, and the minor works will then soon be carried out.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

The Recent Labour Trouble at the Plymouth Gas-Works.

SIR,—Your report in this week's "JOURNAL," of the doings at Plymouth last week, is worthy of very serious consideration by gas directors and managers, who will find there a striking object-lesson showing the condition of helplessness into which it is very easy to drift, and the danger of thus drifting.

The history of the Plymouth Gas Company and their men may be shortly summarized as follows during the last seven years: First, the Union obtained control, which they held for several years. Then, some two years or so ago, stoking machinery was started; there was a tussle, and the Union came off second best; the local Secretary left, in consequence, as reported, of a great decline in the membership; and the Company recovered control of their business with, as was supposed, the prospect of going on smoothly. Now, "like a bolt from the blue," your report appears; and the Union is again in power.

I do not blame the Union. From their point of view, it is war; and, having been worsted, they simply again set to work, and at the proper moment renew the attack and are successful. Neither would it be fair to censure in any way the two chief officials of the Company, who at a moment's notice had to meet a serious crisis. It was a position in which the only feeling one can have towards them is one of profound sympathy.

But how came it that they ever found themselves in such a position? Were all the yardmen in the Union? Why was the Conspiracy and Protection of Property Act so utterly ignored that even the custom of giving a week's notice on either side, where wages are paid weekly (and which custom when not deliberately ignored or set aside by agreement is binding), was not in force? This, however, at the best is but a poor protection; though it would probably have prevented the *fiasco* of last week. The fact of the men having demanded a week's notice is a point in their favour.

Having omitted this very simple and ordinary precaution, no surprise can be felt that, when the Company recovered control, they did not adopt the necessary measures to retain it. To be victors in a contest with a Union is good—providing the cause is just—as far as it goes; but to stop there brings to mind Wellington's saying that such a victory is only better (or not worse) than a defeat. Therefore a further step is necessary if permanent good is to result. If nothing is done to secure the interest and the attachment of the men, a rankling sore will remain waiting for a favourable opportunity to break out afresh, as was illustrated last week.

In the same "JOURNAL" was shown a remnant of the old cordial relations between master and man in the case of Mr. Sellers, of York; but the old relations are fast going—in fact, they are already in most cases, and will soon in all be, gone irrevocably. Hence the momentous question, what shall take their places?

I see but two alternative, and can hear of no more. If they exist, let those who know them speak. The first is, "let sleeping dogs lie," or do nothing. The dogs will wake some day, and then employers will wake to the fact that their men have become more and more alienated and will sooner or later gravitate to the Unions, who will then become masters as in many instances they are already. The second is partnership, as a governing principle, adaptable more or less in various ways to varying circumstances.

The first may not be deliberately and avowedly adopted; but it is easy to follow, and many are drifting along that road, while very few indeed choose the second alternative. The great majority look for safety to a middle course, and so far as can be seen, they will look in vain; for palliatives and half-measures, even if they ever are productive of permanent good, are not the means to cope successfully with the existing conditions of capital and labour.

Partnership. I can laugh at the fears the word created in my mind a few short years ago, and can fully sympathize with others who have similar fears and objections. I admit, at first sight, it is against the grain; but, going by steps, fears and objections vanish. There are, of course, workmen who make no response; but there are many who respond to such advances heartily. Then peace, goodwill, and mutual interest are the result.

In connection with their business, I can wish my brethren in the gas industry no better New Year's wish than that their relations with their men may be as happy and as satisfactory as ours have been during the last seven years.

South Metropolitan Gas Company, Dec. 24, 1896. GEORGE LIVESEY.

The Finding of Security by Gas and Water Officials.

SIR,—Acting on the suggestion in Mr. Holt's interesting letter in the "JOURNAL" for the 22nd inst., I brought the matter before my office staff, who cordially endorse his remarks. The plan of paying all premiums to one company is hardly workable; but if it were possible to obtain full working details of the system adopted in the Post Office, I consider a paying scheme might be initiated. Possibly our Gas Managers' Associations could take up the question, as they are quite in touch with all members of the profession, and many valuable suggestions and much authoritative information would doubtless be obtained from the heads of the different departments of the various companies and corporations in the United Kingdom.

Longton, Staffs., Dec. 26, 1896. W. S. M'GREGOR.

The Comparative Cost of Gas and Electricity in Manchester.

SIR,—With reference to the paper on the above subject read by Mr. G. E. Stevenson at Bradford on the 28th ult., I am sure Mr. Stevenson has inadvertently omitted to state that the comparative table of the costs of supplying gas and electricity in Manchester, of which Mr. Newbigging spoke approvingly, was initiated and compiled by Mr. H. J. Brocklebank, the Statistician of the Manchester Gas Department. This being the first comparison of the kind that has ever been made, so far as I know, I think that honour should be given to whom it is due; and Mr. Stevenson, I feel sure, will hasten to rectify the omission when his attention is drawn to it. "*Palmam qui meruit ferat.*"

188, *Great Clowes Street, Broughton, Dec. 22, 1896.* H. D. HERRING.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Saturday, Dec. 19.

(*Before the* LORD CHIEF JUSTICE *and Lords Justices* LINDLEY *and* A. L. SMITH.)

Hobson v. Gorringe—Is a Gas-Engine a "Fixture"?

As briefly mentioned in the last number of the "JOURNAL," their Lordships to-day gave judgment in the above-named case, which raised a question of general importance, in view of the prevalence of the hire-purchase system as applied to machinery. The point at issue was "the right of a vendor, under a hire and purchase agreement, of a gas-engine, which he has allowed the purchaser to affix to some extent to his land, to recover possession thereof on the failure of the purchaser to pay the stipulated instalments, as against a mortgagee in possession of the land." The question came in the first instance before Mr. Justice Kekewich, who decided in favour of the defendant—the mortgagee; whereupon the plaintiff appealed. The arguments were heard on the 10th and 11th inst.; when their Lordships reserved judgment. This was eventually given in favour of the respondent; thus confirming the view taken by the learned Judge in the Court below. The facts of the case are fully stated in the considered judgment, which we reproduce from "The Times."

Mr. JOSEPH WALTON, Q.C., and Mr. CURTIS PRICE appeared for the plaintiff; Mr. WARRINGTON, Q.C., and Mr. WILLOUGHBY WILLIAMS were for the defendant.

Lord Justice A. L. SMITH, in delivering the judgment of the Court, said: This case, though small as to the amount, raises a considerable question, which is whether a mortgagee of land in fee, when he enters upon the mortgaged premises, can take possession of an engine which is attached to the soil thereof by means of bolts and screws, though the engine did not belong, and never had belonged, to the mortgagor, but to a third party. On Jan. 7, 1895, the plaintiff Hobson, by a contract in writing not under seal, let to a builder named King a gas-engine upon what is known as the "hire and purchase" system, for the purpose of being fixed upon land at Worthing of which King was owner in fee. By this contract, it was agreed that King was to pay Hobson for the engine £18 in cash before delivery, and the sum of £3 10s. per month after delivery for the period of ten months; at the expiration of which time the engine was to become the absolute property of King upon the further payment of £3. It was also agreed that if, during the continuance of the hiring, King should fail to pay the hire, or any part thereof, Hobson should be at liberty to repossess himself of, and to remove, the engine, and that King should have no claim whatever against Hobson either for money he had paid for the use of the engine, or for any damage sustained by reason of the retaking thereof. It was further agreed that the contract should not be construed to operate in any way as a contract for the sale of the engine, but only as an arrangement for the hire thereof, unless and until King should have paid the instalments before mentioned. The engine, as was known to Hobson, was required by King in order to drive a saw-mill which he had upon his land at Worthing; and the way in which it was to be erected, and in fact was erected, was as follows: In the first place, a bed of concrete was prepared in which was embedded two iron plates, out of each of the four outside corners of which an iron bolt projected upwards in a vertical position, having a screw at its uppermost end. The base-plate of the engine was fitted with four holes, one at each outside corner, so that when the engine was placed in position upon the concrete bed the four bolts projected through the four holes in the base of the engine, and nuts were then screwed down tightly upon the tops of the bolts. The gas-engine was thus kept in position, and prevented from rocking and shifting as it would have done if merely placed upon the concrete foundation without the aid of the projecting bolts. An exhaust-pipe and exhaust-boxes and a pulsometer were also let on hire and purchase to King by the plaintiff, together with the gas-engine, which were more or less affixed to the building in which the engine stood. But we do not consider these have any material bearing upon the case; for if the affixing of the engine in the manner above described did not convert it into a fixture, and thus part of the freehold, we do not think that the other attachments, upon the conflicting evidence relating thereto, should be held to do so. The above statement of fact shows what was the ostensible annexation of the gas-engine to the soil of King's land, as also the object for which it was so annexed. King made some of the monthly payments of £3 10s. to the plaintiff, Hobson, and then fell into arrear; and he has never made the contracted payments so as to become the owner of the engine as a chattel. On July 24, 1895 (we omit a prior mortgage of March 26, 1894, for it is not relevant to the point under consideration), King, for valuable consideration, conveyed, by way of mortgage, to the Rev. Mr. Gorringe, his land at Worthing, together with the saw-mill, engine-house, warehouses, and other buildings erected thereon, and the fixed machinery and fixtures, in fee simple, subject to the usual proviso for redemption. On Jan. 17, 1896, King was adjudicated a bankrupt; and in March of that year the mortgagee—Mr. Gorringe—lawfully entered and took possession of the mortgaged premises, together with the gas-engine, which he found in its place as before mentioned. The question is whether, under the above circumstances, Mr. Gorringe is entitled to

the engine. It is not disputed that he is entitled to the land; but the plaintiff—Mr. Hobson—denies that he is entitled to the engine, on the ground that it had never become King's, and had always remained a chattel belonging to himself. There can be no doubt, upon a mortgage in fee of the land, that, as between the mortgagor and mortgagee, the mortgagee is entitled to all fixtures which may be upon the land, whether placed there before or after the mortgage. [His Lordship referred to precedents cited in argument.] Even if a licence had been granted by Gorringe to King to remove the engine during the continuance of a term, Gorringe, by entering and taking possession of the land and engine, would have determined such licence. We now come to the real point made on behalf of the plaintiff. It is this: It was said that this engine never was a fixture, but always remained a chattel, and consequently never passed to Gorringe as mortgagee of the land. It obviously did not pass to him as a chattel under the mortgage to him of "fixed machinery;" for, if a chattel, it ever remained Hobson's and never was the property of King, and unless Mr. Gorringe takes the engine as part of the land mortgaged to him, he does not take it at all. Now, leaving out of consideration for the present the hire and purchase agreement of Jan. 7, 1895' there is a sequence of authorities which establish that the engine, affixed as it was and for the purpose for which it was, to King's freehold, ceased to be a chattel, and became part of the freehold. [His Lordship reviewed the points raised in these cases.] If there had been in the present case nothing but the existing visible degree of annexation of the gas-engine to King's freehold, and the known object for which such annexation had taken place, the authorities conclusively establish that the engine had ceased to be a chattel, and had become part of the freehold. But it was argued that the terms of the hire and purchase agreement caused this engine to remain a chattel, notwithstanding its annexation to the soil; for it was said that the intention of the parties who placed it where it was must be considered, and if this consideration showed that the intention was that the chattel was not to be a fixture, though actually fixed to the freehold, it still remained a chattel. In support of this argument a passage of Lord Blackburn (then Mr. Justice Blackburn), when delivering the judgment of the Exchequer Chamber in *Holland v. Hodgson*, was quoted. The learned Judge, when dealing with what were or were not fixtures, said: "Perhaps the true rule is that articles not otherwise attached to the land than by their own weight are not to be considered as part of the land, unless the circumstances are such as to show that they were intended to be part of the land—the onus of showing that they were so intended lying on those who assert that they have ceased to be chattels; and that, on the contrary, an article which is affixed to the land even slightly is to be considered as part of the land, unless the circumstances are such as to show that it was intended all along to continue a chattel—the onus lying on those who contend that it is a chattel. The question in each case is whether the circumstances are sufficient to satisfy the onus." It is said on behalf of the plaintiff that the hire and purchase agreement shows an intention on Hobson's part, as also on King's part, that the gas-engine should remain a chattel until King had paid the contracted instalments, which he never did. Now, if the engine had been a trade fixture, erected by King as tenant, with a limited interest, we apprehend that, when affixed to the soil, as it was, it would have become a fixture—*i.e.*, part of the soil, and would immediately have vested in the owner of the soil, subject to the right of King to remove it during his term. "Such," says Lord Chief Justice Chelmsford, in *Bain v. Brand*, "is the general law; but an exception has been long established in favour of a tenant erecting fixtures for the purposes of trade, allowing him the privilege of removing them during the continuance of the term. When he brings any chattel to be used in his trade, and annexes it to the ground, it becomes a part of the freehold, but with a power, as between himself and his landlord, of bringing it back to the state of a chattel again by severing it from the soil. As the personal character of the chattel ceases when it is fixed to the freehold, it can never be revived as long as it continues so annexed." It seems to us that the true view of the hire and purchase agreement, coupled with the annexation of the engine to the soil which took place in this case, is that the engine became a fixture—*i.e.*, part of the soil—when it was annexed to the soil by screws and bolts, subject as between Hobson and King to this—that Hobson had the right by contract to unfix it, and take possession of it, if King failed to pay him the contracted monthly instalments. In our opinion, the engine became a fixture—*i.e.*, part of the soil—subject to this right of Hobson, which was given him by contract. But this right was not an easement created by deed, nor was it conferred by a covenant running with the land. The right, therefore, to remove the fixture imposed no legal obligation on any grantee from King of the land. Neither could the right be enforced in equity against any purchaser of the land without notice of the right; and the defendant Gorringe is such a purchaser. The plaintiff's right to remove the chattel if not paid for, cannot be enforced against the defendant, who is not bound, either at law or in equity, by King's contract. The plaintiff's remedy for the price or for damages for the loss of the chattel is by action against King, or, he being bankrupt, by proof against his estate. This, in our judgment, is sufficient to determine this case in favour of the defendant. But as another point has been stoutly argued on behalf of the plaintiff, we will deal with it. It is said that the intention that the engine was not to become a fixture might be got out of the hire and purchase agreement; and, if so, it never became a fixture and part of the soil. It was said that the case of *Holland v. Hodgson* had so decided. For this point it must be assumed that such intention is manifested by the hire and purchase agreement, though, as before stated, we think it is not. Now, in *Holland v. Hodgson*, Lord Blackburn, when dealing with the "circumstances to show intention," was contemplating and referring to circumstances which showed the degree of annexation and the object of such annexation which were patent for all to see, and not to the circumstances of a chance agreement that might or might not exist between an owner of a chattel and a hirer thereof. This is made clear by the examples to which Lord Blackburn alludes to show his meaning. He takes as instances blocks of stone placed in position as a dry stone wall or stacked in a builder's yard; and a ship's anchor affixed to the soil, whether to hold a ship riding thereto or to hold a suspension bridge. In each of these instances it will be seen that the circumstance to show intention is the degree and object of the annexation which is in itself apparent, and thus manifested the intention. Lord Blackburn, in his proposed rule, was not contemplating a hire and purchase agreement between the owner of a chattel and a hirer, or any other agreement unknown to either a vendee or mortgagee in fee of land; and the argument that such a consideration was to be entertained is, in our judgment, not well founded. [His Lordship then dealt with other arguments for the plaintiff based upon decided cases.] That a person can agree to affix a chattel to the soil of another, so that it becomes part of that other's freehold, upon the terms that the one shall be at liberty in certain events to retake possession, we do not doubt; but how a *de facto* fixture becomes not a fixture or is not a fixture as regards a purchaser of land for value without notice, by reason of some bargain between the affixers, we do not understand, nor has any authority to support this contention been adduced. For this reason, in our judgment, the gas-engine became affixed to, and was part of, King's freehold, and thus passed to Mr. Gorringe as mortgagee in fee of King's land. In our judgment, Mr. Justice Kekewich was right when he gave judgment as he did for the defendant; and this appeal must be dismissed with costs.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Tuesday, Dec. 15.

(*Before Mr. Justice* NORTH.)

Jordeson v. Sutton, Southcoates, and Drypool Gas Company.

This was a motion for an injunction; the plaintiff being the owner of some small property in the immediate vicinity of the defendant Company's works at Kingston-on-Hull. He alleged that, owing to the Company's operations in digging a trench for the purpose of making a tank for a new gasholder, his land had been deprived of the support to which it was entitled, and damage had been caused to his property. He asked for an injunction to restrain further proceeding with the excavation, and also to prevent the erection of the gasholder, on the ground that it would interfere with his ancient lights.

Mr. SWINFEN EADY and Mr. POLLOCK appeared for the plaintiff; Mr. HALDANE, Q.C., and Mr. BOOME for the defendant Company; and Mr. RAWLINS, Q.C., and Mr. BARDSWELL, for Messrs. Holme and King, the Contractors for the construction of the tank, who had been added as defendants by amendment since the motion first came before the Vacation Judge.

Mr. POLLOCK, in the temporary absence of Mr. Eady, opened the motion. He said that when the motion was originally made, only a portion of the trench had been excavated, and the height to which the gasholder would rise was not known, so that the only injunction asked was as to digging the trench. Then it was found that the holder would rise to a height of 105 feet, which would seriously interfere with the light; and as the defendant Company would not give any undertaking, it was necessary to add the contractors as defendants. Owing to these delays, the trench had been completed; and he believed the wall was now built. But the expert evidence on the part of the plaintiff went to show that the removal of the core from the interior of the circular trench, which was 152 feet in diameter, would do further damage to the plaintiff's property; and he therefore asked for an injunction to restrain further proceeding with the work.

Some discussion ensued as to the part of the motion which referred to the interference with light. Eventually,

His LORDSHIP decided that he would not deal with this question at present; there being no immediate danger to be apprehended, and there being every probability of the action being tried and decided before the holder could be erected. He also pressed Mr. Pollock as to the probability of any more harm being done by further excavation from the interior of the ring.

Mr. POLLOCK said it was a question of engineering; and he understood the plaintiff's experts were decidedly of opinion that further damage would probably be done if the excavation in the centre was continued. He then proceeded to read the affidavits of the plaintiff, of Mr. J. Bilson, an architect and surveyor, and of Messrs. Brodrick, Ball, and Gelder, also surveyors and engineers—the portions relating to the anticipated interference with light being omitted. The purport of these affidavits was to show the damage which had already been caused to the plaintiff's property, as evidenced by cracks in the walls and yard pavements, and to assert that the work of constructing the trench had been done negligently—sufficient precautions not being taken to prevent the inflow into the trench of a stratum of soft, moving silt, the motion of which was pointed to as the cause of the damage. It was suggested that grooved and tongued sheet-piling should have been adopted, which would have prevented this movement.

Mr. HALDANE, before reading the defendants' affidavits, said the general case put forward was that the damage so far as there had been any—for it was much exaggerated—was caused by the escape of water (not silt at all) into the trench; and no precautions would have prevented this. The defendants had statutory powers, and a statutory duty to supply gas in their district; and in carrying out these duties they were not liable for any damage caused simply by the drainage of their own land and that adjoining it. He then read the affidavit of Mr. Oldfield, the Manager of the gas-works, which stated that the consumption of gas had more than trebled during the last 15 years, and it was absolutely necessary that further storage should be provided. He therefore prepared plans and specifications, and put the work in hand. He denied that the work had been done negligently.

The affidavits of Mr. Wissenden, the Engineer, and of Mr. Runton, the Chairman of the Company, having been read, the case was adjourned.

Wednesday, Dec. 16.

On the case being resumed this morning,

Mr. HALDANE read an affidavit by Mr. Thomas Newbigging, in which he said that he had never seen or heard of grooved and tongued sheet-piling being used for such work as that in question; that it would be impracticable, and even if practicable would not be effectual

in keeping out the water. The tank was not of an unusual size or depth. Mr. Andrew Dougall, the Manager of the British Gaslight Company, at Hull, made an affidavit to a similar effect. Messrs. Samuelson, Wellsted, and Todd, all engineers, had made a joint affidavit, in which they said that the plaintiff's property was very badly built, and the damage could be repaired at a trifling cost; also that some of the cracks were of old standing. There was also a further affidavit by Mr. Runton.

Mr. RAWLINS then read the affidavits filed on behalf of the defendants, Messrs. Holme and King. These were by Mr. Marsh, the Engineer to the firm, who had the general superintendence of the work, Mr. Charles Gott, C.E., of Bradford, but formerly of Hull, Mr. Gashell, architect and surveyor, of Hull, and Mr. Wissenden, the Resident Engineer under Mr. Marsh. The effect of their evidence was that the work had been carried out in a thoroughly proper and satisfactory manner. They maintained that the wall and puddling had been completed; and that no possible injury could be caused by the removal of the central core. They also said they had never known of grooved and tongued planking being used for such work, and that it would not be watertight.

Mr. SWINFEN EADY read the affidavits in reply. These went to show that the damage to plaintiff's property had gone on increasing, and that further excavation would be prejudicial; but they did not deal specifically with the statements in the affidavits of the defendants as to the effect of removing the core.

After a short argument by Mr. EADY, urging that an injunction should be granted,

Mr. Justice NORTH delivered judgment. Without calling on Mr. Haldane, he said the matter which he had to deal with on the motion was easily disposed of. The Gas Company requiring a larger supply of gas for their district than they were able to provide by their present works, proceeded to make a large new gasholder. For this purpose, an excavation of 35 feet in the ground was required; so that when the holder was filled with gas, it should rise to a considerable height above the surface of the ground. The defendants were making this excavation near the edge of their own property. First of all they dug a circular trench, round the outer circumference of the area upon which the holder would stand—some 8 or 10 feet wide and 35 feet deep, that being the depth they intended to go. This trench having been dug all round, they proceeded with the thick retaining wall that had to be built all round it—supported by means of piers, and puddled on the outside. The excavation was completed in September, since which time they had been working at the wall. This had now been completed, and nothing remained to be done but to add the coping to it (of which nobody could complain), and to insert certain stone blocks in certain parts near the bottom, of which no complaint could be made either. This was the state the works had reached now; and the question was what injunction could be granted. Of course, the Court could not do anything to interfere with what defendants had done down to the present time. The question whether they had been right or wrong in what they had done was one which might have to be dealt with at the trial; but it was immaterial now, unless what the defendants proposed to do further was a matter in respect of which an injunction could be granted. It was said that it was; and if he (his Lordship) thought it to be so, he should have to hear the other side. The matter stood in this way: The wall was completed all the way round; it went down to the greatest depth; and it was carried up as high as it was to be carried with the exception of the coping. In constructing it, the wall and the puddle had been carried down to the depth of 35 feet, where it rested in a solid dry bed of clay, reaching over the whole area; and the bottom of the wall and puddle had been let into, and connected in such a way with the bed of clay at the bottom that no water could get through the wall above the bed of clay. At present, therefore, there was an area surrounded by an impervious wall; but there was a core of earth inside the wall which would have to be taken away to some extent before the gasholder could be completed. Round the sides (just within the wall) the excavation would be carried practically to the bottom of the wall; but it would not be so deep in the centre of the circular area, because the soil would be left in the form of a core rising in the centre, much nearer to the surface of the ground than the outer part of the holder, immediately within the wall. Could the excavation of the soil within do any harm? His Lordship did not see how it possibly could. The water could not get through the soil and puddle. The evidence was that the excavation had got down to a point at which it touched the stratum of clay. There was no suggestion in the evidence that the removal of the centre core would have the effect of bursting-up the floor of the tank in any way; and he did not see on the evidence any suggestion that this centre core was required for any purpose whatever. It was quite true that in the plaintiff's affidavits there were general words to the effect that further excavation would cause injury to the plaintiff, and removing the core wholly or in part would be a further excavation. But this was not complained of specifically. The defendants' witnesses, however, stated specifically that the removal of the core could not possibly do any harm. The affidavits of the plaintiff's witnesses in reply did not deal with this point, further than confirming their previous evidence. The affidavits of Mr. Marsh, Mr. Gott, and Mr. Wissenden—all gentlemen apparently quite competent to speak on the point—were not challenged in any way. Therefore, his Lordship did not see his way to granting an injunction to restrain the defendants from proceeding with the excavation of the earth within the circular wall, which the evidence showed had now been completed. With regard to the question of light, he had pointed out that this was not a matter which he could deal with now. The plaintiff said that if the holder was completed to a height of 105 feet, it would materially interfere with his ancient lights. It might be so; but the defendants were not ready to receive the holder yet—much less to erect it. There was no probability of any injury arising with respect to light before the trial of the action, especially as it was clear that the holder was being constructed of larger size than was wanted for the immediate requirements. It was not at all likely therefore that when it first came into use it would be used to its full capacity or anything like it. The best course for him to take was to refuse the motion, giving the plaintiff leave to make any application with regard to light if he desired to do so. As there were many points raised by the motion which were not yet ripe for decision, the costs would be made costs in the action.

CENTRAL CRIMINAL COURT.—Monday, Dec. 14.

(*Before the Recorder, Sir* CHAS. HALL, Q.C., M.P.)

Dealing in Stokers' Gloves Stolen from the West Ham Gas Company.

In the "JOURNAL" for Sept. 15 last and two succeeding issues, we reported the case (heard at the North London Police Court) in which *William Wilkes*, a greengrocer and carman, of Hackney Wick, was charged with having stolen and received a number of stokers' gloves, the property of the West Ham Gas Company. Prisoner was committed to the Old Bailey for trial. The matter first came before the Recorder at the October Sessions; but it was then adjourned in consequence of the illness of one of the detectives. At the November Sessions, prisoner was tried, and found guilty of receiving.

Mr. STEPHEN LYNCH (instructed by Messrs. Hilleary, of 5, Fenchurch Buildings, E.C.) appeared for the prosecution; Mr. ARTHUR HUTTON for the defence.

Briefly, the facts of the case were these: The gloves in question were valued at 16s. per dozen; and the prisoner alleged that he bought them at 8s. per dozen, and sold them chiefly to Messrs. Berger and Sons, Chemical Manufacturers, of Homerton, for 12s. per dozen. It appeared that stokers' gloves had for some time been disappearing from the West Ham and other Gas Companies' works; and therefore the prosecutors in this case had had their gloves marked "W.H.G.C." It was usual for each stoker to have a new pair of gloves once a month—this being about the time they could be used; and it was not the custom to ask for the old ones back. The Company bought so many gross of gloves at a time, and placed them in a store. They were unmarked; but they were occasionally handed to the foreman, who marked them, and gave them out to the men. According to a statement made by prisoner when arrested, he had on several occasions bought gloves from a man named Jemmy Finch, of Bromley, who was a stoker at the West Ham and other works; and he believed they were collected by him from West Ham and Beckton. Some two or three years ago, Finch informed him that the gloves in future would be marked, as so many had been seen outside the works; but he (Wilkes) told him they would be of no use to him if they were marked, as nobody would buy them. Since then Finch had several times brought him some unmarked. Wilkes also owned to having purchased gloves of a foreman named Haynes (now deceased) at the Bromley Gas-Works; of a foreman and a man named Moore employed at the West Ham Gas-Works; and of stokers at Beckton. Finch had also brought to him gloves marked "G.L.C.C.;" but with these he refused to have anything to do.

The evidence given at the November Sessions was similar to that laid before the Magistrate at the Police Court; and, as already stated, prisoner was found guilty of receiving. The Recorder, however, let him out on his own recognizances to come up for sentence on the 14th inst., upon the understanding that, in the meantime, he should give information to the police as to his confederates. The police saw him, but could get no information from him. His wife said "he had better do a bit of time rather than give away his pals." In 1879, Wilkes was convicted of stealing, and sentenced to twelve months' imprisonment, with hard labour.

The RECORDER, in delivering judgment, said the prisoner knew that the sources from which he received the gloves were tainted; and there was no doubt that a wholesale robbery had been going on by his confederates, whose names he would not disclose. The police had, however, informed him (his Lordship) that for some years, since prisoner's previous conviction, he had carried on an honest living; and therefore he did not intend to rake up that conviction against him. He was willing to believe that prisoner had been a tool in the hands of others, who were probably persons who did not have the necessity for wearing stokers' gloves. He should commit him to prison for six calendar months, with hard labour.

The Charge of Embezzlement against a Collector.

At the Westminster Police Court last Tuesday, Henry John Prosser, late a collector in the service of The Gaslight and Coke Company, was finally examined before Mr. De Rutzen on charges of embezzlement and falsification of accounts. Mr. C. O. Humphreys prosecuted; and Mr. Kapadia appeared for the defence. The accused had been for 22 years with the Company; and at the time of his arrest on the 1st inst., he was in receipt of a salary of £275 a year. On the part of the prosecution, it was said he had been guilty of grave irregularities, and that he was considerably in arrear a day or two before his arrest. It was stated in evidence that he borrowed a sum of £100 and other moneys, as he said, to put his accounts straight, and that when he presented himself at the office and was given into custody, there was no actual indebtedness to his employers. The defendant pleaded "Not guilty" to the charges, and reserved his defence. He was committed for trial; but bail was accepted.

The Cromer District Council in a Dilemma.—After a somewhat desultory discussion at the last meeting of the Cromer District Council, on a proposal that a Committee should be appointed to make inquiries as to the advisability of purchasing the water-works, it was discovered that several of the members were interested in the Company, and that only four were qualified to take any steps in the matter. Under these circumstances, it was agreed that the Clerk should make application to the County Council for a dispensation allowing those members who would otherwise be unable to take part in the proceedings, to vote on the matter. The motion was then adjourned until the next meeting. Notice of motion was also given to the effect that the purchase of the gas-works and the question of electric lighting should be added to the work of the proposed Committee.

MISCELLANEOUS NEWS.

THE SOUTH METROPOLITAN GAS COMPANY AND THEIR WORKMEN.

The Employees' Investments.

The present which it is the custom of the Directors of the South Metropolitan Gas Company to make to all their workmen at Christmas time is accompanied by a card conveying their good wishes for the season. On the present occasion, they express their belief that the good-will and mutual confidence between the Company and their employees which sprang out of the memorable circumstance of 1889 are fully maintained; and they present some interesting figures showing the progress of the profit-sharing system then instituted. There is invested in the Company's stock, in the names of 780 employees, £34,709; 2151 of them hold in the names of trustees £11,370; and there is on deposit with the Company, at interest, £25,653—making a total of £71,732. The total increase on the year amounts to £21,386; at Christmas 1895, it was £15,000. The figures show the total accumulations, in the past seven years, of the portion of the annual profit-sharing bonus left in the Company's hands *plus* other voluntary savings and interest. A total of £46,079 has been invested from time to time in the purchase of £40,500 of the Company's ordinary stock, the present value of which is upwards of £59,000, due partly to judicious purchases. There remains on deposit at 4 per cent. interest, in addition to this investment, £25,653. Consequently, the accumulations of the profit-sharing bonuses, savings, interest on the same, and increase in the market value of the investment, now mount up to the respectable figure of £85,000 owned by the employees, and invested in, or deposited with, the Company. The total amount of the profit-sharing bonuses since the start is rather over £70,000. By the last Act of Parliament, £40,000 of stock is the minimum required for employee representation on the Board; and it has been reached sooner than was expected.

THE RECENT STRIKE AT THE PLYMOUTH GAS-WORKS.

Work proceeded as usual at Plymouth Gas-Works last week; and, as the men profess to be now entirely satisfied, there is no immediate reason to fear a repetition of the recent agitation. On Sunday, the 20th inst., the day following the settlement of the dispute, the men held an open-air meeting on one of the quays near the works. Mr. Brabham, the District Secretary of the National Union of Gas Workers and General Labourers, was the principal speaker; and the most interesting point in his address was a reference to the strike itself. He had, he said, been in Plymouth many days trying to bring about an amicable settlement; and when he went away on the Thursday, the men became exasperated at what they believed was unfair treatment by the Company. He was not there to defend their conduct; but when working men believed they were being unfairly treated by their employers, they did not realize the seriousness of such an action as the gas workers were guilty of on the Friday. He added that the Union, which had in that district a membership of only 200 twelve months ago, now had 1300 members; and he intimated that the attention of the officials was being directed to the case of the riverside workers and the builders' labourers.

The dispute has given rise to the usual difference of opinion in the local papers. The "Western Morning News" roundly condemns the action of the men, whose conduct, it says, was most reprehensible. "In the case of a private individual, it would have been bad; but where the public interests and the public safety were jeopardized, such action is wholly inexcusable. When the mischief was done, the local representative of the Trade Union seems to have been anxious to divest himself of responsibility for it. The value of this disavowal must be measured by knowledge of the fact that the same gentleman kept the dispute open for six weeks by an absurd insistence upon the demand that the Company should recognize him and his precious Union, instead of dealing directly with their own workmen, with whom they might have settled it in a couple of days. It is not a pleasant reflection that the public are largely at the mercy of the Brabhams, the Gardeners, the Tom Manns, and the Will Thornes who represent the New Unionism." The "Western Daily Mercury," on the other hand, defends the men, who, it holds, would have been "wanting in self-respect and loyalty to their fellow-members if they had not in some way resented the treatment Mr. Brabham received." The men, it contends, have "as much right to put Mr. Brabham forward as their agent and spokesman as the Directors of the Gas Company have to use their Secretary or Manager in a similar capacity." This out-Brabhams Brabham, and is a rather remarkable extension of the Union official's own claim to interfere between employers and their workpeople.

WOKING WATER AND GAS COMPANY.

An Extraordinary Meeting of this Company was held last Tuesday at the London Offices, 5 & 6, Great Winchester Street, E.C.—Mr. CHARLES HORSLEY, J.P., in the chair—for the purpose of authorizing, if thought expedient, the raising of additional capital.

The CHAIRMAN explained that the capital had been overspent; and the Directors wanted more money to put the accounts in order and to expend on further work. They had still £2500 that they could raise; but this was not sufficient for their purposes. They therefore wished to borrow the sum of £2062 under the Frimley and Farnborough Act. In the case of water-works, it was necessary to be constantly making extensions; and when a water company ceased to spend money, they might know it was in bad form. He therefore asked the shareholders to agree to a resolution, authorizing the borrowing of "£2062 by virtue of the provisions of the Frimley and Farnborough District Water Act, 1893, in respect of the additional capital of £8250 issued under the powers of the Surrey and Hants District Water-Works Act, 1887." The Directors were not going to spend the money all at once on new works. They were constantly looking out for water, and were driving adits, and doing all they possibly could to increase the supply. They had already done some excellent work in this way, and had found a large amount of extra water. Their Engineer (Mr. J. Quick) had just informed the Board that, at one of their new extensions, they had found a really good tangible supply. The Directors wished to raise the money for which they asked by debentures, as this would eventually be cheaper than issuing ordinary shares.

Sir JOHN BAKER seconded the motion.

The CHAIRMAN, replying to questions, said the money was required for their own district, and not for Frimley. The Directors had not yet decided the terms upon which they would issue the debentures. Some of his colleagues thought they would get the money at 3½ per cent.; but his own opinion was they would not get it under 4 per cent. The shareholders, however, would be informed of the terms.

Mr. T. M. QUILL suggested that the debentures should be issued at 4 per cent., with a small premium.

The motion was unanimously carried; and the usual votes of thanks concluded the meeting.

THE NEW CHIMNEY AT THE EDINBURGH GAS-WORKS.

In the "JOURNAL" for the 1st inst., our Scotch Correspondent recorded the fact that his "Notes" for that issue were begun under exceptional conditions; the place selected by him for starting his weekly letter being no other than the top of the new chimney then just completed at the Edinburgh Gas-Works, from the designs of Mr. R. Mitchell, the Engineer and Manager. It was mentioned at the time that a description of the chimney had been prepared by Mr. Mitchell for distribution among the guests invited by the Gas Commissioners to be present at the formal completion of the work; and, as the new chimney, which is 250 feet high, will doubtless, like its predecessor, be an object of interest to many visitors to "Modern Athens," especially those who are connected with gas manufacture, we give the following particulars in regard to it:—

The operations were commenced on Nov. 25, 1895, and the whole structure was completed on Nov. 21, 1896. The chimney is situated 116 feet south of the old stalk; and the excavation for the foundation was taken out 32 feet square and to 23 ft. 6 in. below the retort-house floor-level. At this depth suitable rock was met with. In order to provide a solid base, and distribute the weight equally over the surface of the site, portland cement concrete was put in 7 ft. 6 in. deep and 32 feet square. This was also to prevent heat from the flues penetrating down to the rock and disintegrating it, as had happened in the old chimney. At the base, the brickwork consists of fifteen footing courses built solid for a height of 4 feet in cement mortar with first quality Whitehill composition bricks, except in the centre and under the flue openings, where fire-bricks bedded in fire-clay were used. There are four flue openings, each 7 feet high by 4 feet wide, arched over. Only three of these can be utilized; but the fourth was inserted to give the stalk an equal bearing, and was afterwards built up.

The chimney proper, immediately above the footing courses, is 22 ft. 6 in. square measured outside; the inner portion being wrought on a circle 16 feet in diameter. The thickness of the walls at this part is 3 ft. 3 in., or four bricks; and this is continued plumb to 2 feet above the retort-house floor-level, where a splayed course of pink Hailes stone forms the first offset of 4½ inches. From here the pedestal has a gradual taper of 1 in 100 to a height of 43 ft. 6 in. above floor-level, where a cornice of Prudham stone 18 inches deep is placed; the thickness of the walls in this section being 2 ft. 10½ in., or 3½ bricks. The four corners of the cornice are splayed up with Prudham stone to meet the circular shaft. From the top of this cornice the chimney is built circular, inside and outside, to the finish, the external diameter being 20 ft. 11 in. at the commencement, tapering with a batter of 1 in 55 to 14 ft. 9 in., 35 ft. 3 in. below the summit. This uppermost division is carried up plumb, and highly ornamented with Prudham stonework; and the whole is surmounted by a large cast-iron cap, weighing 21 tons, made in 48 pieces bolted together with internal flanges. Above the pedestal the walls are 2 ft. 5½ in., or three bricks, thick, for a height of 50 feet, where they are reduced to 2 ft. 0·5 in., or 2½ bricks, thick, for the next 55 feet; continuing at 1 ft. 7 in., or two bricks, thick for another 50 feet, from which point to the top the walls are 1 ft. 2 in., or 1½ bricks, except where the stone and iron work project beyond the face of the building.

To strengthen the structure, and assist in binding the work together, hoop irons laid on edge are inserted at about every 6 feet in the height. These are each made in four sections in the circumference, lapped at the joints, and bolted together with bolts having countersunk heads.

At about 4 feet above the retort-house floor-level, eight openings are left in the main shaft for the admission of air to the inner cavity of the chimney; and these are furnished with movable gratings, so that the supply of air can be regulated. Outlets for the heated air are left at the top in the centres of the arches above the panels. These are formed by means of terra-cotta ventilating bricks. The outside of the chimney is faced with red bricks, which gives it a perfectly uniform and handsome appearance, forming a pleasing contrast with the Prudham stone.

Within the walls of the shaft a lining of fire-brick set in fire-clay is constructed, with an inside diameter of 11 feet at the bottom, and taken up perpendicular to within 72 feet of the top, where it is gradually tapered to 10 ft. 6 in. diameter. This lining commences with a wall 15 inches thick at the bottom, and is built thus for 57 feet, whence it continues for the next 85 feet at 9 inches thick. Here it is further reduced to 4½ inches, and carried up at this dimension for 110 feet; and thereafter corbelled over and bonded with the composition brickwork of the shaft, with which it forms a solid wall to the head of the chimney. Ties consisting of fire-brick blocks are set into this lining

at intervals of about 6 feet in height, for the purpose of steadying and connecting it with the main walls. These blocks span across the air cavity, and have a bearing of 4½ inches on each side.

The lightning conductor, which is of copper, having a conductivity of 93 per cent., is according to Dyle's patent, and consists of six solid wires with insulated testing wire in the centre, made in one piece, and terminating in a 1-inch copper rod with gilded points at the summit. Connected to this, and fixed round the head of the chimney, is a flat coronal, provided with short elevation rods. The conductor is led down the south side of the chimney, and finishes with a copper plate 3 feet square. This forms the "earth;" and it is bedded in coke about 20 feet below the surface of the ground and 25 feet distant from the chimney. A test-box is provided, whereby the continuity and satisfactory work of the conductor may be ascertained from time to time.

The total number of bricks in the new chimney is 459,750; and the weight of the whole structure, exclusive of the concrete foundation, is 2469 tons. The cost of the entire work was upwards of £4000. All the plans and sections required in connection with the construction of the chimney, many of which were of full size, were prepared in the drawing office at the gas-works.

ELECTRIC LIGHTING NOTES.

Having succeeded in carrying through the Hull Town Council their proposals to construct new electric lighting works at a cost of £42,000, the Electric Lighting Committee have been encouraged to make another move. This time it is East Hull that they are desirous of favouring; and to furnish that district with the electric light means an expenditure of an additional £10,000. They have therefore decided to increase by this sum their application for a loan.

The Moss Side District Council have entered into an arrangement with the Manchester Corporation for the transfer of their Electric Lighting Order. The latter undertake to supply Moss Side with electric lighting for a term of fifteen years, refunding to the Council the cost of obtaining the Order and of the transfer deed, on condition that the charges in the district are in all respects the same as those made within the city. The District Council are to be enabled to repurchase the undertaking within six months after fifteen years, or any subsequent fifth year.

An exhaustive report on the electric lighting of Douglas has been prepared by the Town Clerk (Mr. T. H. Nesbitt). Those members of the Council who favour electricity as an illuminant and those who do not, as well as the public generally, are nearly evenly divided; but the report is strongly in favour of electric lighting, which, according to Mr. Nesbitt (whose opinion must be based on very narrow experience), is quite a perfect system. He recommends its adoption on grounds of cleanliness, absence of deleterious fumes, purity, steadiness, and safety, as compared with other methods of lighting. As a health and pleasure resort, Douglas, he believes, would be incalculably benefited by the adoption of the electric light; and the beauty which already characterizes Douglas Bay would be enhanced. With perhaps the exception of the Bay of Naples, the report says, no place lends itself so admirably to effective lighting as Douglas Bay. Continuing, the report is in favour of the municipalization of all public undertakings, including electricity, workmen's dwellings, public baths, and water-works. In Douglas, however, exceptional circumstances prevail; and the Isle of Man Tramway and Electric Power Company, should, in the judgment of the Town Clerk, be entrusted with the work of supplying the electric light, on satisfactory terms being arranged.

At the first ordinary general meeting of the Africa Trust, Limited, last Wednesday, the Chairman (Mr. H. Rider Haggard), in the course of his remarks when addressing the shareholders, stated that, among the other assets, the Trust had a very large interest in an undertaking called the African Concessions Syndicate. The object of this Syndicate was to carry out a scheme to use the water power of the Victoria Falls on the Zambesi River, with the object of utilizing it to generate electricity, and supply it to the various centres of population throughout Rhodesia, either in the form of power to work stamps and mills, or of motive power for other purposes. This great scheme—the greatest electrical scheme, perhaps, of the century—had been modelled upon that already achieved at the Falls of Niagara, which, vast as they were, he believed were surpassed in size by the Victoria Falls of the Zambesi. This undertaking had the advantage of being reported upon by Professor Forbes, F.R.S., the Engineer of the Niagara Falls works, who proceeded to Africa for the Syndicate during the year 1895. Subsequently, also, it has been favourably reported upon by Professor Hopkinson, F.R.S. Of course, the success of the enterprise was measurable by the success of Rhodesia. If Rhodesia proved a failure, it would fail; if, as most people were convinced, it proved one of the greatest colonizing achievements of our colonizing race, the scheme would prove a grand success.

Rival Street-Lamps at Killarney.—Visitors to Killarney some time ago were surprised to find that the town enjoyed a dual illumination by gas and electricity. Arc lamps and gas-lamps were seen standing side by side in all their refulgent rivalry in every part of the town; and the meaning of this it was difficult to fathom. The explanation lay in the fact that the Town Commissioners were divided on the public lighting question, and each section succeeded in giving a contract to two rival Companies. The Auditor has now decided that the cost of one of the illuminants must be borne by some parties other than the ratepayers, who were content with one system of lighting.

Incandescent Gas Lighting at Barnes and Mortlake.—The local Surveyor having made a report favourable to the economy of incandescent gas lighting, of which system an experiment has been made, it has been resolved to alter all the Sugg lamps in Mortlake and Barnes by fitting them with incandescent burners, and to replace all the ordinary jets with incandescent burners; while all new public lamps are to have special lanterns and incandescent burners. Any ratepayer who may agree to pay 15s. per lamp may have the public lamp in his neighbourhood fitted with a special lantern and incandescent burner. The latter is, however, to become the property of the Council, and to be under their control.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This is the period when, without particular reason, people take to summing up their gains or losses. In the gas industry, 1896, so far as Scotland is concerned, is not difficult to review. The purveyor of gas has reason to be satisfied with his position. The cloud of commercial depression which long hung over the land, had rolled away; and in most industries there was great activity. There was consequently more money to spend; and more money was spent upon gas than was ever the case before. There was scarcely a gas undertaking—there certainly was not one of any note—which did not record an increased output of gas. The general improvement in trade may account largely for this; but another and more particular reason is probably to be found in the more widespread use of automatic prepayment meters for the sale of gas. These, wherever introduced, have been found to lead to an increased consumption. The output of gas having increased, it follows that, generally, the revenue has been higher, though in one or two instances, on account of reductions in price, the revenue did not surpass the total of the previous year. This, however, did not affect the general prosperity of business. During the year, coal has risen slightly in price; but this took place chiefly after contracts were entered into, and consequently many gas undertakings are at present consuming coal which they have secured at even lower rates than in 1895. This circumstance was probably the principal factor in determining the price of gas, which in many cases—in fact, in nearly every instance—sustained a reduction.

The year has been a commercial and industrial, not an inventive one. No new processes were brought out; but of the latest inventions several have been taken up. An installation of the Peebles oil process has been fitted up in the Paisley Gas-Works, and is almost ready for being brought into use. This will place the second system of Mr. W. Young on a working scale, for the first time, and enable the process to be tested on its merits. A carburetted water-gas installation is being fitted up in the Edinburgh Gas-Works by Messrs. Humphreys and Glasgow, of London. A gasholder upon the wire-rope guided principle introduced by Messrs. Ashmore, Benson, Pease, and Co. has been constructed at Falkirk, and was successfully inaugurated on the 10th inst. Another holder of the same description is being erected by the firm in Perth. New gasholders have also been put up in Glasgow, Kilmarnock, Loanhead, and Renfrew. At Rothesay, the gas-works were transferred to a new site in October; and negotiations are in progress for transferring the Perth works from their present site in the centre of the city to Friarton Farm, where they will have the advantage of both railway and wharf service. Extensions of works have been in progress in Glasgow, Greenock, and other places. A new chimney has been built in Edinburgh, to take the place of the existing one, which will be removed in the course of 1897. At the present moment, the new chimney—which is a structure of some artistic appearance—is being gradually seasoned by heat before being brought into use.

The municipalization of gas undertakings goes on apace. In the course of this year, the Dunfermline Town Council have acquired, by arbitration, the undertaking of the Dunfermline Gaslight Company. The burgh of Portobello was, by Act of Parliament, amalgamated with the city of Edinburgh; and it was part of the arrangement, scheduled to the Act, that the Corporation should acquire the undertaking of the Portobello Gas Company. The Corporation have since made over the undertaking to the Edinburgh and Leith Gas Commissioners, on the same terms as they themselves acquired it. Negotiations are in progress with the object of transferring the local gas undertakings to the Corporations in Stirling and Saltcoats. At Coatbridge, a proposal for a transfer was made; but it fell through. At Brechin a similar proposal has been sometimes mentioned; but no progress has been made with it. Of other notable incidents, may be mentioned the abolition of meter-rents at Dundee, Perth, and Montrose; and the registration as limited liability companies of the Gas Companies at Cupar, Loanhead, and Bridge of Weir.

Two eminent gas engineers have been removed by death—Mr. John M'Crae, of Dundee, in October, and Mr. F. T. C. Linton, of Leith, ten days ago. Mr. William Brodie, of the firm of Messrs. William Brodie and Sons, of Paisley, died in the early part of the year.

Electric lighting has been introduced into Ayr and Fort William during the year; and a small installation is about to be started in Paisley. The existing installations have all done well; the Edinburgh one particularly so. Incandescent gas lighting has also increased greatly—probably at a much greater ratio than electric lighting.

Prices for residual products have been exceptionally low. This, combined with the slight rise in the price of coal, may tend to make the balance-sheets for next year not quite so favourable as those which were produced in the course of this year. It is satisfactory, however, to know that the volume of business is constantly augmenting, and that the gas industry seems, in face of the keen rivalry it now encounters, to have entered upon a new period of youth.

The re-arrangement of the engineers' department of the Edinburgh and Leith Gas Commission, to which I made reference on the 8th inst., has come about with startling suddenness, and in a way not altogether anticipated. The proposal which was before the Special Committee whom the Commissioners appointed on Nov. 30, was that both their Engineers—Mr. Mitchell, of Edinburgh, and Mr. Linton, of Leith—should be allowed to retire upon allowances; both the gentlemen being in a state of health which precluded them from giving full attention to their duties. This proposal the Commission adopted. The allowance to Mr. Linton was fixed by statute at £450. Mr. Mitchell had no allowance fixed; and he was consequently at the mercy of the Commissioners. In this state of matters, the Committee agreed to recommend an allowance of only £250 to him. Even this, I understand, was not agreed to without dissent. There are Commissioners who do not believe in any retiring allowances being given—particularly to men in high position; and of this stamp there were two who objected. One of these I heard say that Mr. Mitchell had himself dispensed with the services of men in his employment when they became, as he was now himself, unfit for their duties; and as he gave

them no allowance, he should get none himself. Such reasoning, happily, did not prevail; and the Committee recommended as above. The allowance is a very meagre one, when it is considered that Mr. Mitchell has struggled for 16 years in a cramped situation, where, with a rapidly growing output of gas, he had, perforce, to find room for extensions of plant time after time, till the works are now so packed together that there is scarcely room to turn in them, and yet was able to produce gas of high quality and of satisfactory bulk. His post has been no sinecure. In fact, he has been the hardest wrought gas manager in Scotland. Taking everything into account, the Commissioners, I consider, might have treated him with greater liberality. I understand, however, that he himself is satisfied with the provision; and so I refrain from saying anything more on the subject.

Whatever regret there may be at the retirement of Mr. Mitchell—and there always is a feeling of sorrow at the close of a public career—it is as nothing to that which attaches to the case of Mr. Linton. This is the most pathetic story I have ever encountered in connection with gas-works management. The Committee, on Monday, the 14th inst., agreed to recommend that he be allowed to retire on his statutory allowance; and the Commissioners were convened on the succeeding Monday to consider the recommendation. But on the day immediately preceding that on which they were to meet, a higher power called Mr. Linton away. It almost draws tears to the eyes to think of so melancholy a termination of a useful public life. The Commissioners met; but before doing so in public, they sat in committee and amended the report which was to come before them. There was no longer any need to recommend anything relating to Mr. Linton; and this portion of the report was deleted. At the public meeting, the amended report was read; and Lord Provost M'Donald, in deep silence, proceeded to say that he believed he expressed the great regret of them all at the death of Mr. Linton, the Engineer and Manager of the Leith works. They all knew that Mr. Linton had been labouring under very poor health for a long time; and it was partly his wish to get quit of the responsibility of his post on account of that. He was often away from the works; and so was Mr. Mitchell, in the same way. The Committee had arranged for a retiring allowance being paid to Mr. Linton, as well as to Mr. Mitchell, and to bring in one man to superintend the works—a strong and vigorous man, who would throw all his heart and energy into his work, and pay close attention to the undertaking. They thought this would be in the interest of the Commissioners. They were still under consideration of these proposals when Mr. Linton died; and they need say no more regarding him, so far as the report was concerned. He moved that they send a letter of condolence to his family and friends. This having been agreed to, the Lord Provost then said that they came to the case of Mr. Mitchell; and he thought they should go on with the recommendation regarding him. He moved accordingly; and Provost Bennet, of Leith, seconded. Councillor Waterston, of Edinburgh, moved disapproval; and Councillor Kinniard, of Leith, seconded. On a division, 17 voted for the motion, and 2 for the counter-motion. In Mr. Mitchell's case, the retirement is to take place at March 31, or sooner, if arranged.

It has all along been the intention of the Commissioners that when a vacancy occurred in the Engineers' department, the work should be concentrated in the hands of one official, as is the case in Glasgow and other places; but no one, until quite recently, could have contemplated such a sweeping re-arrangement as has taken place. Mr. Linton has been known to be in poor health for years. Few, perhaps none, knew how serious was his ailment, until he was practically laid aside altogether. Mr. Mitchell's health has also been very shaky for several years; but he was much the more robust of the two, and his retirement was not thought of until quite recently. It will be remembered that he went to South Africa in the autumn; and he returned feeling quite re-invigorated. He was not long home, however, before the old symptoms reappeared. It is now quite apparent, in the wan appearance of his countenance, that there is a deep-seated functional derangement somewhere. For him it is most desirable that he should be relieved of the worries of his post, and that he should have an entire change of scene. The action of the Commissioners will allow of this; and it is sincerely to be hoped that his health will improve.

So "the old order changeth, giving place to the new." The Commissioners have already advertised for an Engineer; and applications are to be sent in by Jan. 15. I understand it has been agreed that the present Assistants are to be appointed Works Managers—Mr. A. Masterton in Edinburgh, Mr. A. J. Walker in Leith, and Mr. D. Vass in Portobello. With regard to the Engineer to be appointed, the Commissioners have resolved not to offer any sum, but to let applicants state what they are prepared to accept. There are already a great many inquiries after the post; and though nothing has been, or can be, decided until all the applications are received, I believe there are certain understandings among the Commissioners, with respect to age and the like, which will make the process of selection, when the time comes, comparatively easy. One of these understandings I do not consider I would be doing wrong in communicating; that is that they do not want a man who will be merely an ornament. The man without a handle to his name will have the same chance as the man with one. They are resolved that the man to be appointed shall be one who has shown capacity in the management of gas-works, no matter what his other qualifications may be. This is the right spirit in which to approach the subject; and if they stick to it, they will deserve credit.

The business of the Commissioners continues to grow satisfactorily. At the meeting on Monday, it was reported by the Engineers that there had been an increased output of gas during November, as compared with the same month of last year, of 10,682,000 cubic feet; and an increase in the period from May 16 over the corresponding period of last year, of 43,937,000 cubic feet. Referring to this, Bailie Kinloch Anderson said the increase was very satisfactory; but they were not satisfied. They had resolved to push the sale of gas for cooking, heating, and motive power; and they hoped that, as well as increasing the output, they would be able to reduce the price.

The Police Commissioners of Saltcoats have agreed to pay the price asked by the Directors of the Gas Company for their undertaking—£10,200—and the works will now become the property of the Corporation. The transfer has been effected mutually.

Another "indignation meeting" of Stirling ratepayers was held on Wednesday night, but was not largely attended. It was resolved to authorize the Ward Committees to take the opinion of the community on the subject of the proposed gas transfer by ballot, post-card, or otherwise.

The Arbroath Gas Corporation, on Monday, resolved to increase the salary of the Manager (Mr. R. S. Carlow) by £25 a year. In committee, Bailie Jarvis moved the increase, which was seconded by Councillor Harvey. Ex-Bailie Strachan moved that no increase should be granted; and this was seconded by Dean of Guild Duncan. Councillor Lorimer moved, as a further amendment, that Mr. Carlow be granted an honorarium of £25 for the year to come, on the understanding that, should his services continue to give satisfaction, the granting of a similar honorarium would be considered yearly. Councillor Henderson seconded this amendment. On a division, Mr. Lorimer's amendment was carried against that of ex-Bailie Strachan; and on a final vote, the recommendation to increase the salary as stated was carried by 11 votes to 5. The Corporation have unanimously adopted the Committee's recommendation. Since Mr. Carlow entered on his duties as Gas Manager for the Corporation in 1881, the price of gas has been reduced from 5s. 2½d.—less 2½d. of a rebate—to 3s. 11½d., at which it now stands. The leakage has been reduced from 14·17 per cent. to 7·98 per cent., which means a large annual saving; and the amount of tar and liquor produced at the works per ton of coal carbonized has been increased from 45·3 gallons to 65 gallons, which again results in a considerably increased annual revenue on this account. When Mr. Carlow was appointed, the annual make of gas was 37,697,000 cubic feet, whereas it is now 52,718,600 cubic feet. The total amount paid for salaries and wages in 1880 was £1361; while last year the amount was £1480, which shows that the cost for wages per million cubic feet of gas manufactured is considerably lessened, which is largely due to the erection of improved plant on Mr. Carlow's recommendation. Last year chemical works for the manufacture of residual products were erected in the gas-works; and the result of a year's working is a saving to the Corporation of nearly £300, while it is estimated that for the ensuing year the increase will be even larger.

THE LANCASHIRE COAL TRADE DURING 1896.

Notwithstanding the activity which characterized all the principa coal-using branches of industry, the past year can scarcely have been productive of very satisfactory results to the owners of collieries throughout the Lancashire district. In the first place, the exceptional mildness of the winter, at the commencement of the year, threw upon the market large quantities of round coal which would otherwise have gone into consumption for domestic purposes; and this, no doubt, had a considerable effect in bringing about the exceptional depression in all the lower-class round coals, which has perhaps been one of the most extraordinary features of the past year's trade. The better qualities of round coal, following the usual course of the market, receded in price during the summer months, to the extent of 9d. to 1s. per ton. They have, however, since generally got back to about the same level as that at which they stood at the commencement of the year; any appreciable advance upon this being quite exceptional. Best Wigan Arley coals, which in January last averaged 10s. to 10s. 6d. per ton, and in summer got down to 9s. 6d., are now about 10s. 6d., and in some special cases 11s. Pemberton four feet and seconds Arley, which averaged 9s. to 9s. 6d. per ton, and dropped to about 8s. 6d., are back to about 9s. Perhaps no more conclusive proof of the extreme depression prevailing in the market, with regard to common round coals, could be afforded than the excessively low prices at which the usual railway locomotive fuel and gas coal contracts were competed for. The necessarily largely increased consumption for manufacturing purposes, owing to the general improvement throughout the iron, engineering, and other allied branches of industry, seemed to have no effect upon the output of common round coal coming upon the market; and ordinary descriptions, suitable for steam and forge purposes, were readily obtainable at as low as 5s. 6d. per ton at the pit. Indeed, so altogether unsatisfactory and apparently hopeless was the prospect of any material improvement in the lower qualities of round coal, that colliery proprietors in many cases resorted to every possible means of restricting the output, and in not a few instances ceased working altogether the unremunerative common mines. When the railway contracts for locomotive fuel came upon the market early in the year, the eagerness of colliery owners to obtain an outlet for their surplus supplies was such that the 1895 prices, which had previously been regarded as excessively low, were at once forced down 6d. per ton; the railway companies being able to renew their contracts at 5s. 9d. per ton at the pit. Much the same giving way in prices followed when the usual gas coal contracts were placed upon the market. Early in June, when a good many tenders had been sent in, it became evident that the gas companies would have little or no difficulty in placing their contracts on even more favourable conditions than those of the previous year, when extremely low prices were taken by Lancashire coalowners. At first there was a giving way of about 3d. per ton; the figures on which tenders were based averaging about 6s. 6d. per ton for common, to 7s. for best qualities of gas coal. Gradually, as the season advanced, the increasing competition to secure contracts brought the average figures at which anything like large quantities were placed to about 6s. per ton for ordinary Wigan four-feet, and 6s. 9d. for good Arley gas coal. On a few contracts, about 3d. per ton above these figures was obtained; but generally the basis was 3d. to 6d. per ton below the previous year's contract prices. Towards the close of the year, there has been some substantial improvement in common round coals, which in a considerable measure has been due to the largely increased shipping requirements for steam purposes. During the greater part of the year steam coal for shipment has been readily obtainable at about 6s. 6d. to 6s. 9d. per ton, delivered at the ports on the Mersey—representing barely 5s. at

the pit mouth. With the enlarged shipping demand that has been steadily coming forward during the last quarter of the year, shipping prices have improved quite 1s. per ton; and with a lessened surplus offering for inland sale, pit prices have also gone up to a corresponding extent—the closing quotations of the year being about 6s. 6d. per ton at the pit mouth. Engine classes of fuel have varied with the fluctuations in demand for round coal, which have necessarily affected the supplies of slack coming upon the market; but it has been chiefly in the inferior sorts where prices have shown any very material margin of difference. The collapse of the Coal Trade Conciliation Board has been a notable incident of the past twelve months; and the rate of miners' wages, as a result, is an open question during the ensuing year. Already there are indications of restlessness among the men, with regard to a return of the 10 per cent. reduction to which they consented two-and-a-half years back. In fact, this is to be discussed at the Miners' Federation Conference next month; and though it is altogether improbable that any definite action will immediately follow for securing an advance in wages, it is practically a matter of certainty that during 1897 demands will be put forward for at least an increase of 10 per cent. on the present rate. With a continuance of the general improvement in trade, the coalowners will no doubt feel themselves bound to concede this.

COAL TRADE REPORTS.

Northern Coal Trade.—There is the usual effect of the holidays experienced since last report—a diminished production of coal, and a difficulty in obtaining cargoes for immediate needs. In the Northumbrian steam coal trade, the demand has increased also; and one of the best collieries has been able to raise the price. Generally, however, the quotation is 7s. 9d. per ton f.o.b. for best steam coal. As there is a scarcity now, it is probable that the firmness in the price may be continued for a week or two, till the output is raised to its normal amount. In the gas coal trade, the demand is a very heavy one. For immediate delivery, as much as 8s. 3d. per ton has been paid for a single cargo, though large quantities are being delivered at fully 2s. per ton below this price, on account of contracts entered into in the summer. Gas coke is very plentiful; and stocks are now increasing. Prices are unaltered.

Scotch Coal Trade.—Matters are quiet just now in the coal trade, with the exception that there has been some extra demand for splint for gas-works, which are now at their busiest period of the year. The miners intend to have their wages question discussed at a general Federation at Leicester on Jan. 5; but it is not expected, outside their ranks, that anything will result. The prices quoted are: Main, 6s. 9d. (firm) per ton f.o.b. Glasgow; ell, 7s. to 7s. 3d.; and splint, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 146,764 tons—an increase when compared with the previous week of 21,610 tons, but a decrease on the corresponding week of last year of 2829 tons. For the year to date, the total shipments have amounted to 7,501,903 tons—an increase upon the same period of last year of 145,180 tons.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 26.

Sulphate of Ammonia.—The week has been a short one as far as the market has been concerned, in consequence of the intervening holidays. Nevertheless further progress has been made in values; and the supplies in Scotland having been fairly absorbed to fill important Colonial orders, the market shows an improvement at all the ports. The quotations to-day are £7 10s. Hull, and £7 12s. 6d. Leith and Liverpool, with an increase of 2s. 6d. per ton for early, and 5s. per ton for late, January delivery. Consumers follow the advance very cautiously; and only the high premium asked by makers for spring months prevents a larger business being done in that position.

Nitrate of Soda is unchanged on spot at last week's quotations; and there is no new feature in cargoes for arrival.

LONDON, *Dec.* 24.

Tar Products.—The pressure for benzol deliveries continues; and it is the most encouraging sign of the position of this article that, at a time when the largest production is going on, a firmer tone has developed. It is doubtful whether any benzols have changed hands at the low prices that have been mentioned in some of the trade journals, as low, in one instance, as 2s. 6d. per gallon for 90's. Naphthalene is still in request; and in the present indifferent state of the creosote market, its diversion into other channels is an undoubted boon to the distiller. Pitch is firmer; and buyers, who have withheld from the market for some months, are now nibbling again. Solvent naphtha is scarce, with a tendency to higher prices; while crude naphtha for forward delivery is practically unsaleable, though for spot the price continues fairly firm. Carbolic acid is strong, with a tendency to higher rates. Tar is selling at lower prices.

The following values represent the week's business:—Tar, 17s. 6d. to 23s. 6d. Pitch, 25s. to 28s. Benzols, 90's, 2s. 9d.; 50's, 2s. 6d. Solvent naphtha, 1s. 7d. Crude, 30 per cent., naphtha, 1s. 2d. Creosote, 1⅜d.; liquid, 2¼d. Heavy oils, 40s. Naphthalene, 65s.; salts, 30s. Carbolic acid, 60's, 2s. 3d. Anthracene, "A," 10d.; "B," 8¼d.

Sulphate of Ammonia is firmer, with a decided tendency to higher rates. There is a pinch on apparently for prompt delivery, which looks as if "bear" dealers were trying to cover. Considerable business has been done at £7 10s. to £7 15s., less 3½ per cent., which may be taken as the price at all ports.

Charges for Water for Baths at Pudsey.—A dispute has arisen between the Pudsey District Council and certain ratepayers as to the rights and powers of the former to make a separate charge, over and above the usual water-rate, for water used in baths. Legal advice has been taken by both sides; but an effort will be made to settle the question amicably. A deputation has been appointed to wait on the Council, asking them to revise their scale of charges so that the terms are more reasonable to residents in houses of a rental of from £5 to £20, and requesting them to make one charge cover all domestic purposes, instead of having three separate charges.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 1282.)

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	23—25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17½—18½	..	4 1 1
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	107—110	..	4 10 11
200,000	10	29 Oct.	5	Belgrano (B. Ayres), Limited	10½—11	..	4 10 11
100,000	Stck.	26 June	5	Do. 5 p. c. Deb. Stk	104—107	..	4 13 5
200,000	5	12 Nov.	6½	Bombay, Limited	7¾—8¼	..	3 18 9
40,000	5	,,	6½	Do. New, £4 paid	5¾—6¼	..	4 3 2
380,000	Stck.	13 Aug.	12	Brentford Consolidated	285—290	..	4 2 9
210,000	,,	,,	9	Do. New	215—220	..	4 1 9
50,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
139,375	,,	11 Dec.	4	Do. 4 p. c. Deb. Stock.	130—134*	..	2 19 9
220,000	Stck.	16 Sept.	11½	Brighton & Hove Original	250—255	+8	4 10 2
208,820	,,	,,	8½	Do. A Ord. Stk.	185—190	..	4 9 5
933,500	Stck.	28 Aug.	5	Bristol, 5 p.c. max.	127—132	..	3 15 9
420,000	20	15 Oct.	11¼	British	56—57	..	3 18 11
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	22—23	..	5 0 0
71,000	10	,,	8½	Do. 7 p. c.	19—20	..	4 5 0
500,000	10	15 Oct.	6	Buenos Ayres (New) Limited	10¼—10⅜	..	5 11 8
200,000	100	1 July	6	Do. 6 p. c. Deb.	103—105	..	5 14 3
150,000	20	15 July	8½	Cagliari, Limited	29—31	..	5 6 5
100,000	10	30 Sept.	6	Cape Town & District, Ltd.	16½—17½	..	3 8 8
50,000	50	3 Nov.	6	Do. 6 p. c. 1st Mort.	57—59	..	5 1 8
550,000	Stck.	15 Oct.	13½	Commercial Old Stock	338—343	..	3 18 8
165,000	,,	,,	10½	Do. New do.	255—260	..	4 0 9
165,000	,,	11 Dec.	4½	Do. 4½ p. c. Deb. do.	150—155*	..	2 18 0
800,000	Stck.	12 June	13	Continental Union, Limited.	268—273	..	4 15 2
200,000	,,	,,	10	Do. 7 p. c. Pref.	220—225	..	4 8 11
51,600	Stck.	28 Aug.	14	Croydon Com'cial A 10 p. c.	315—320	..	4 7 6
163,400	,,	,,	11	Do. B 7 p. c.	250—255	..	4 6 3
535,000	Stck.	28 Aug.	5¼	Crystal Palace Ord. 5 p.c. Stk	140—143	..	3 13 5
60,000	,,	,,	5	Do. 5 p. c. Pref.	140—145	..	3 9 0
486,090	10	15 July	11	European, Limited	26—27	..	4 1 6
354,030	10	,,	11	Do. £7 10s. paid	18—19	..	4 6 11
5,746,590	Stck.	13 Aug	12¾	Gaslight & Coke, A, Ordinary	317—322	+2	3 18 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	110—115	..	3 9 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	305—315	..	3 3 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	147—152	..	3 5 9
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	212—217	..	3 9 1
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207—212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	305—315	..	3 3 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	172—177	..	3 7 10
1,061,150	,,	11 Dec.	4	Do. 4 p. c. Deb. Stk.	137—142*	..	2 16 4
294,850	,,	,,	4½	Do. 4½ p. c. do.	150—155*	..	2 18 0
908,000	,,	,,	6	Do. 6 p. c. do.	203—208*	..	2 17 7
70,000	10	29 Oct.	6	Hongkong & China, Limited	12—13	..	4 12 4

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
3,800,000	Stck.	12 Nov.	12	Imperial Continental	210—215	—3	5 11 7
376,400	100	1 Aug.	4	Do. 4 p. c. Debs. Red.	100—103	..	3 17 8
473,600	Stck.	13 Aug.	3½	Do. 3½ p. c. Deb. Stk	105—108	..	3 4 10
75,000	5	11 Dec.	6	Malta & Mediterranean, Ltd.	5¾—6¼*	..	4 16 2
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	111—115	..	4 6 11
250,000	100	,,	4½	Do. 4½ p. c. Debs.	108—110	..	4 1 10
541,920	20	12 Nov.	5	Monte Video, Limited	16—17	..	5 17 8
150,000	5	26 Nov.	8	Oriental, Limited	8½—9	..	4 8 11
135,000	5	,,	8	Do. New, £4 10s. paid	7½—8	..	4 10 0
15,000	5	,,	8	Do. do. 1879, £1 paid	1½—2	..	4 0 0
60,000	5	16 Sept.	7	Ottoman, Limited	5—5½	..	6 7 3
420,000	100	2 Nov.	6	People's Gas } 1st Mtg. Bds.	102—107	..	5 12 1
500,000	100	1 Dec.	6	of Chicago } 2nd Do.	100—105	..	5 14 3
250,000	10	30 Sept.	10	San Paulo, Limited	13—14	..	7 2 10
5,475,000	Stck.	13 Aug.	5⅜	South Metrop., 4 p.c. Ord.	145—149	..	3 9 9
820,000	,,	15 July	5	Do. 5 p. c. Deb. Stk.	171—174	..	2 17 6
60,000	Stck.	16 Sept.	11½	Tottenham & Edmonton, A	270—280	..	4 2 3
60,900	,,	,,	8½	Do. B	180—190	..	4 9 5
170,380	10	29 May	10	Tuscan, Limited.	14—15	..	6 13 4
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	101—103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	26 June	10½†	Chelsea, Ordinary	338—343	..	3 1 3
150,000	,,	,,	5	Do. 5 p. c. Pref.	177—182	..	2 14 11
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	160—164	..	2 14 10
175,785	,,	30 Sept.	4½	Do. 4½ p. c. Deb. Stock	162—167	..	2 13 11
1,719,514	Stck.	15 Oct.	7	East London, Ordinary	228—233	..	3 0 2
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	163—168	..	2 13 7
225,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	105—107	..	2 16 1
700,000	50	11 Dec.	7½	Grand Junction, 10 p.c. max.	115—120*	..	3 2 6
295,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150—155	..	2 11 7
708,000	Stck.	13 Aug.	12	Kent	335—345	..	3 9 7
160,000	,,	,,	7	Do. New, 7 p. c. max.	215—220	..	3 3 7
1,043,800	100	26 June	9¾†	Lambeth, 10 p. c. max.	275—280	..	3 7 10
406,200	100	,,	7½	Do. 7½ p. c. max.	225—230	..	3 5 2
350,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	150—153	..	2 12 3
500,000	100	13 Aug.	12⅝	New River, New Shares	418—423	..	3 1 0
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk.	150—155	..	2 11 7
902,300	Stck.	12 June	6†	S'thwk & V'xhall, Ordinary	152—157	..	3 16 6
126,500	100	,,	6†	Do. Do. 7½ p. c. Max.	148—153	..	3 18 5
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	175—180	..	2 15 6
1,019,585	,,	30 Sept.	4	Do. 4 p. c. A Deb. Stk.	148—152	..	2 12 7
1,155,066	Stck.	11 Dec.	10	West Middlesex	310—315*	..	3 3 6
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	163—168*	..	2 13 7

† Next dividend will be at this rate. *Ex div.

Oil-Gas Plant at Winchester.—The Winchester Water and Gas Company are having an oil-duct laid down between the railway station and the gas-works, for the purpose of working it in connection with an oil-gas plant.

New Borrowing Powers for the Salford Corporation Gas Department.—In a General Bill which the Salford Corporation are proposing to promote in the ensuing session of Parliament, they will seek power to borrow £85,000 for gas-works purposes.

Reduction in Price.—The Directors of the Thurso Gas Company have decided to reduce the price of gas 4d. per 1000 cubic feet, making it 6s. 4d., as from the 1st prox., and to allow a discount of 2½ per cent. upon all accounts amounting to 10s. and upwards, if they are paid by the dates named therein.

The Public Lighting of Falmouth.—The subject of the indifferent lighting of the public streets was under consideration at a meeting of the Falmouth Town Council last Wednesday. Dr. Banks said the need for light was much felt in the outskirts of the town, and when the nights were long and dark, and the moon was obscured by clouds, the want of light was a positive danger. He moved that the lamps be lit every night unless orders were given to the contrary. Mr. H. Liddicoat, the ex-Mayor, said they were undoubtedly a long way behind in the matter of public lighting. He wished the Committee who had charge of the matter would consider the question of adopting the incandescent system for the street-lamps, as had been done in Truro. Dr. Banks mentioned that the price of gas was to be further reduced by the Gas Company from 3s. 4d. to 3s. per 1000 cubic feet. An amendment to defer consideration of the question of the continuous lighting of the lamps was defeated, and the motion was carried.

The Proposed Purchase of the Budleigh Salterton Gas-Works.—The overtures which the Budleigh Salterton District Council have made to the Gas Company, with a view to the purchase of the gas-works, have not met with a very encouraging reception. At the last meeting of the Council, a letter was read from Mr. T. Parker, the Secretary of the Company, in reply to the Council's inquiry whether the Company were disposed to sell the works, and upon what terms. The letter stated that, while the Directors were not anxious, under present circumstances, to sell, at the same time, having regard to the desire of the Council to become possessed of the property, they would part with it on the basis of a statutory undertaking, the cost of the valuation to be paid by the Council—one expert to be engaged on each side, and to have absolute power to settle terms. Mr. Parker added that, as the Company had recently engaged the services of a Consulting Engineer to build new works, and to proceed with them without delay, it must be understood that all liability thereon must be taken over by the Council in addition to the valuation of the present works. The Clerk was instructed to write the Company to the effect that the Council were not prepared to enter into any negotiations for the purchase of the works except upon the basis that no payment should be made for goodwill; and that unless the Company were prepared to assent to this basis, it was useless to continue the correspondence.

The Proposed Water-Works for North Walsham.—The North Walsham District Council have made application to the Local Government Board for power to borrow £4000 for the purpose of erecting new water-works.

Southborough Gas-Works.—The Southborough District Council have just borrowed £4000 from the Ecclesiastical Commissioners, to be repaid, with interest at the rate of £3 2s. 6d. per cent., within a period of forty years. It is part of a sum of £15,000 authorized by the Council's Act of 1892 for the erection of new gas-works, which are now being proceeded with.

Proposed Water-Works at Midhurst.—Mr. F. H. Tulloch, M.Inst.C.E., has held an inquiry, on behalf of the Local Government Board, with respect to the application of the Midhurst District Council to borrow £15,000 for works of water supply and drainage, under a scheme prepared by Mr. W. Santo Crimp, M.Inst.C.E. An experimental boring has been made 176 feet deep, lined to 150 feet with 8¼-inch steel tubing. Water was tapped at 150 feet; the yield being about 200,000 gallons per diem. Mr. Santo Crimp said the supply when perfected would give at least 41,000 gallons a day. It was proposed to build a reservoir to hold 120,000 gallons, which, allowing 20 gallons per head, would be equal to three days' supply.

The Illuminating Power of Leeds Gas.—The reports for last month of Mr. T. Fairley, the Leeds Corporation Gas Examiner, and Mr. C. Buckley, the Magistrates' Inspector, on the illuminating power of the gas show little variation in the results. Mr. Fairley gives his average, with a standard argand (24-hole) burner and a 6-inch chimney, as 18·4 candles, and with a standard batswing burner, as 18·7 candles. Mr. Buckley's tests, with a 24-hole burner and a 6-inch chimney, gave the following results: York Street, 18·43 candles; Sheepscar, 18; Kirkstall, 18·29; Wortley, 18·33; Dewsbury Road, 18·16; average, 18·24 candles. This is an improvment on the returns made in previous months by Mr. Buckley, when the City Justices addressed a complaint to the Gas Committee (see *ante*, pp. 1020, 1040).

Hackney and the Water Question.—Last Thursday week, Mr. T. M'Kinnon Wood, the Chairman of the Parliamentary Committee of the London County Council, addressed a public meeting in Hackney on the "London Water Question." At the close of his remarks, the following resolution was carried unanimously: "(1) That this public meeting of the inhabitants of Hackney resolve that the health, convenience, financial interests, and general well-being of the district and the Metropolis urgently demand the speedy transfer of the duty of supplying the inhabitants of London with water to the County Council; (2) that, in the event of the Companies now authorized to supply London failing to agree to a reasonable price for their undertakings, Parliament be urged to sanction the establishment of a competing supply under the control of the London County Council; and (3) that consumers be advised to resist any attempts to increase the present exorbitant charges of the Water Companies, more particularly of the charges for the so-called non-domestic supplies, especially the charges for garden watering and baths."

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The South Essex Water Company's New Reservoir.—The new reservoir which has been constructed for the South Essex Water Company at Flog Hill is 132 feet long, 88 feet wide, and 12 feet deep, and has a capacity of 868,000 gallons. It is situate 208 feet above sea-level. In its construction 900 tons of bricks, 415 tons of cement, 1650 tons of gravel and sand, and 35 tons of ironwork were used.

The Amalgamated Water-Gas Companies, Limited.—The ordinary general meeting of this Company is to be held on Thursday, when the Directors will report that, after protracted negotiations, the Uddingston property and business has been taken over as a going concern by the trustees of Mr. Stewart's estate—thereby doing away with a liability of £15,000; and the shareholders will be asked to ratify the agreement entered into. The trustees have consented to waive Mr. Stewart's reduced claim for fees as a Director of the North British Syndicate, amounting to £500; and so has Mr. Samson Fox. It is hoped that the three remaining Directors will adopt the same course; thus further reducing the Company's liabilities by a sum of £2500. The accounts accompanying the report show a balance of loss for the year of £2440. The shareholders are to be called together to deal with the question of raising further capital for carrying on the business; but this will not be done until after the hearing of the libel action that has been brought by Mr. Fox against the Editor and Publisher of "To-Day."

The registered offices of the Pneumatic Painting Machine (1895) Corporation, Limited, have been removed to 23, College Hill, E.C.

The Lighting Corporation, Limited, have just fixed ten of their "Improved Wenham Street-Lamps" outside the Holborn Town Hall, Gray's Inn Road.

Mr. Willey, Gas Engineer, of Exeter, has invited about 300 of his employees' children (between the ages of four and twelve) to a tea and entertainment, to be given by him at the Royal Public Rooms next Saturday.

The Gas, Water, and General Investment Trust, Limited, give notice that the coupons of the first mortgage 6 per cent. bonds of the Salt Lake and Ogden City Gas and Electric Light Company, due on the 1st prox., will be paid, on and after that date, at the National Provincial Bank of England, E.C., or at the Farmers' Loan and Trust Company, New York.

The value of "Pulsometer" pumps in dealing with large quantities of water has on several occasions been pointed out in our columns. That the efficiency of these appliances has not been exaggerated has just been proved in the case of the raising of the *Orotava*, the liner which capsized a few days ago in dock. The successful raising of this vessel was, it seems, largely due to the use of these pumps, some of which are capable of lifting 600 tons of water a minute.

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They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES HYDRAULIC REGULATORS VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director,
Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications re Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 300 British Gas-Works.

ANDREW STEPHENSON,
182, GRESHAM HOUSE,
OLD BROAD STREET,
LONDON, E.C.

Telegrams: "Volcanism, London."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."
[For Illustrated Advertisement see Dec. 1, p. 1050.]

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c. CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.
Before placing Orders, please write for Estimate.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality.
Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE. Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND Co., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR wanted.
BROTHERTON AND Co., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE wanted.
BROTHERTON AND Co., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID for Sale.
BROTHERTON AND Co., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

TUBES for Gas, Steam, and Water (all Sizes), Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 1222, last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

WANTED, a Situation as Stoker, or to take Charge of a Small Gas-Works. Age 31. Four Years' good character; Total Abstainer. Can do Fitting or Main laying if required.
SAMPSON, Gas-Works, Tidworth, MARLBOROUGH.

WANTED, by the Gas Committee of the Corporation of Wigan an OUTDOOR FOREMAN. Wages £2 2s. per week.
Particulars of the duties may be obtained from, and applications addressed to, the undersigned.
References only required.
JOS. TIMMINS,
Engineer, &c.

WANTED, a Gas-Stove Salesman who thoroughly understands all kinds of Gas Cooking Ranges, Gas-Fires, and Gas Heating Appliances. Salary 45s. per week.
Applications (by letter), stating Age, Experience, and enclosing recent Testimonials from previous employers, to be addressed to No. 2771, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CITY OF SHEFFIELD.

RESIDENT ENGINEER FOR LITTLE DON VALLEY NEW WATER-WORKS.

THE City Council of Sheffield on the 9th of December, 1896, passed the following Resolution in connection with the construction of a Reservoir and Works in the Langsett Valley:—

"The Work to be designed and constructed under the charge and direction of an experienced Civil Engineer (to be called 'the Engineer'), who shall reside in the Little Don Valley, or at Sheffield, and devote the whole of his time to his duties under the Corporation, and who shall have daily personal charge of the Work in the Langsett Valley, and be responsible for it throughout, and shall do all special work in connection therewith, which the Water Committee may desire; the Staff of Assistants, Inspectors, Draughtsmen, Clerks, and others being provided by the Corporation, and under the direction of the Engineer."

"The Engineer shall consult with the 'Consulting Engineer' with regard to all Plans and Designs, and at every step during the progress of the Works, but without thereby lessening his own absolute responsibility; and he shall report direct to the Water Committee, from whom alone he will take directions."

"The Salary to the Engineer to be from £1200 to £1500 per Annum, and the engagement to be until the completion of the Langsett Reservoir, subject to Twelve Months' Notice."

Applications are accordingly requested from competent ENGINEERS; it being indispensable that Candidates for the appointment should have had considerable experience in Designing and Constructing Impounding Reservoirs.

Each application must furnish at least two References, and contain *copies* of Testimonials (which cannot be returned, and which, preferably, should be printed); the Water Committee having the right to call for production of the originals.

The application must state Age, Experience, present Position, Salary required, when at liberty, and general state of Health.

The Engineer's Services are sought at present for the construction of the first Reservoir authorized to be made under the Sheffield Corporation Water Act, 1896, to be called the Langsett Reservoir, which will be one of great magnitude.

Another large Reservoir is authorized by the Act, which is intended to be constructed after the completion of the Langsett Reservoir; and in an adjoining Valley—that of the River Ewden—the Corporation have power, and intend afterwards, to construct two other large Reservoirs.

Personal canvassing will be a disqualification.

Communications to be sent to me not later than the 11th of January, 1897, marked on the outside "Langsett Engineer."

HERBERT BRAMLEY,
Town Clerk.

Town Hall, Sheffield,
Dec. 23, 1896.

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

WANTED, a Secretary and Manager combined, for a Gas-Works producing 16 Million Cubic Feet of Gas per annum.
All Particulars may be obtained from, and applications addressed to, HY. CROSS, Esq., Solicitor, Prescot, LANCS.

EDINBURGH AND LEITH CORPORATIONS GAS.

THE Commissioners require a fully- qualified Gentleman to fill the position of CHIEF ENGINEER and MANAGER of their Works at Edinburgh and Leith, and invite written Applications, addressed to the undersigned, by the 15th prox.

Applicants must have a thorough practical knowledge of the Manufacture and Distribution of Gas, and be capable of Designing and Superintending all necessary Extensions from time to time.

For further Particulars apply to
JAMES M'G. JACK,
Clerk.

25, Waterloo Place, Edinburgh,
Dec. 21, 1896.

OIL-GAS BENZOL for Enriching Coal Gas. A few Thousand Gallons to dispose of.
Apply, by letter, in the first place, to No. 2714, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS Plant, both new and second-hand, ready for delivery, including Retort-Fittings, Condensers, Exhausters, Scrubbers, Purifiers, Meter, Governor, and Gasholder. **Inquire Price and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

COMPLETE GAS PLANT FOR SALE.

TO BE SOLD separately, or in one lot—
One large Double-Lift HOLDER, with Cast-Iron Tank, 46 ft. 6 in. diameter by 16 ft. deep, with Inlet and Outlet Pipes.
Two Double-Lift HOLDERS, 34 ft. 4 in. diameter outer, 32 ft. 10 in. inner, 14 ft. 3 in. deep, with Pipes, &c.
One GOVERNOR, SYPHON BOXES, VALVES, &c.
One STATION METER, with Valves (new), Braddock's make.
One Set of four PURIFIERS, 7 ft. square by 4 ft. deep, Walker's make, with Grids and one of their Centre-Valves, Connections, and Lifting Gear.
One TAR-PUMP and STORE BOILER.
One Eclipse WASHER-SCRUBBER, Laycock and Clapham, with Pulleys and Governor, erected in 1890.
One EXHAUSTER, with 12-inch Valves and Connections.
One Horizontal CONDENSER, with fourteen 8-inch Pipes, 18 ft. long, with Bye-Pass, Valves, and Connections.
Twenty RETORT MOUTHPIECES, with Lids and Duplicates, Dip, Ascension, and Bridge Pipes, Hydraulic Main and Valve, Fire-Doors, Buckstaves, and Tie-Rods.
12-inch and 8-inch MAINS, at per ton.
12-inch VALVES, at each.
For further Particulars and Prices, apply to H. I. WILLIAMS AND Co., Kidsgrove, STOKE-ON-TRENT.

CROYDON COMMERCIAL GAS COMPANY.

FOR SALE—
Two HORIZONTAL ENGINES, by F. Horne, of London, fitted with Air-Pumps, for use with Surface Condenser. Cylinders 13½-inch Bore, and 22-inch Stroke.
Two HORIZONTAL ENGINES, by D. Millar, of London, 23-inch Stroke. Cylinders, one 12-inch, and one 11½-inch, with Plunger Air-Pumps, and 4 ft. 6 in. Fulleys.
One EXHAUSTER for 50,000 cubic feet per hour, by Waller, of London, with 14-inch Inlet and Outlet Valves and Connections.
One EXHAUSTER, by Donkin, of London, 40,000 cubic feet per hour, with 16-inch Valves and Connections.
Two BYE-PASS GAS-GOVERNORS, complete.
One CORNISH BOILER, by Cochrane, Grove, and Co., 22 feet long by 6 feet diameter, with five Galloway Tubes, and all necessary Fittings, &c., fitted with Perret's Dust Furnace, with Vertical Engine, and Blower complete.
Also the following VALVES:—
Twelve 16-inch Rack and Pinion Valves, by Donkin.
Two 12-inch Rack and Pinion Valves, with Columns and Hand-Rails.
One 10-inch Rack and Pinion Valve.
One 8-inch Rack and Pinion Valve.
All the above are in good condition, and may be seen on application to the ENGINEER, Gas-Works, Waddon, CROYDON.
Also at CARSHALTON—
One GASHOLDER 80 feet diameter.
One GASHOLDER 60 feet diameter.
Three PURIFIERS 12 feet square, with 12-inch Connections.
One Good's WASHER, with 12-inch Connections.
One HORIZONTAL ENGINE and EXHAUSTER.
A number of FIRE-CLAY RETORTS, 18 inches diameter, by 9 ft. 3 in long.
HYDRAULIC MAINS, FITTINGS, &c.

GOODSON'S Patent Self-Acting Gas GOVERNORS and BURNERS.
For Illustrated Advertisement, see "JOURNAL" for Nov. 17, p. 968.
GOODSON AND Co., 213, Vauxhall Bridge Road, LONDON, S.W.

SULPHATE OF AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEWBATTLE, DALKEITH, }

GAS TAR and Ammoniacal Liquor Wanted.
Apply to JOSIAH HARDMAN, Milton, STAFFS.

SULPHURIC ACID for Sale (B. O. V. and R. O. V.) made from Spent Oxide.
The EXECUTORS of the Late JOSIAH HARDMAN, Chemical Works, Milton, STAFFS.

PURIFIERS FOR SALE—A Set of Four 10 feet square, with Connections, Valves, and Lifting Gear complete. Ready for removal. Also Two 6-Horse Power CORNISH BOILERS.
Can be seen, and further Particulars obtained, at the GAS-WORKS, MAIDENHEAD.

TENDERS are invited for Lighting the City of S. PAULO (BRAZIL) BY GAS, and must be sent under sealed covers, marked "Illuminaçao a Gaz da Cidade de S. Paulo," to the Secretaria da Agricultura, Commercio, e Obras Publicas (Department of Agriculture, Commerce, and Public Works), in time to reach the said Department not later than Three o'clock p.m., on April 30, 1897.
Particulars may be had on application, by letter, to the BRAZILIAN LEGATION, LONDON; or to the BRAZILIAN CONSULATES in LONDON, LIVERPOOL, or GLASGOW.

ACCRINGTON DISTRICT GAS AND WATER BOARD.

THIS Board are prepared to receive TENDERS for the FIRE-BRICKS and FIRE-CLAY which may be required at the Accrington and the Great Harwood Works of the Board during the Year from the 31st of March, 1897, to the 31st of March, 1898.

Tenders, endorsed "Tender for Fire-Bricks," and addressed to the Chairman of the Board, must be received at the General Offices, St. James's Street, Accrington, on or before Monday, the 11th of January next.

By order,
CHAS. HARRISON,
General Manager.

Dec. 25, 1896.

COUNTY BOROUGH OF HALIFAX.

THE Gas-Works Committee of the Halifax Corporation are prepared to receive TENDERS for the supply of (1) WROUGHT-IRON GOODS, (2) IRON VALVES and CONNECTIONS, (3) WET and DRY GAS-METERS, (4) STEEL GOODS, (5) FIRE-CLAY GOODS, (6) STOKERS' GLOVES, (7) IRONMONGERY, and (8) CLOTHING and CAPS, required during the ensuing Twelve Months.

Forms of Tender and further Particulars may be obtained on application to Mr. Thomas Holgate, C.E., Gas Engineer, Halifax.

Tenders, properly endorsed, to be sent to the undersigned before Ten o'clock a.m., on Wednesday, the 6th of January, 1897.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
KEIGHLEY WALTON,
Town Clerk.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company so far as they relate to CAPITAL STOCKS WILL BE CLOSED at Four o'clock p.m., on Tuesday, the 5th day of January next, and will be RE-OPENED immediately after the Half-Yearly General Meeting of the Company to be held in the month of February next.

By order,
JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Dec. 24, 1896.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Powers.
He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.
Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.
Offices: 18, FINSBURY CIRCUS, E.C.

In Paper Covers, Post Free 2s.

STEPHEN CARPENTER, late of the Bow Common Gas-Works, on the PURIFICATION OF COAL GAS BY LIME, &c., and the Method of Working Lime Purifiers so that the Lime may be used a second time, with a Description of a short Method of Working the Sulphur Test.

S. CARPENTER, "Ryde," Woodhouse Grove, East Ham, ESSEX; or of H. W. CARPENTER, 3, Bedford Villas, Carshalton, SURREY.

THE "COOMBE" DRAUGHT SCREEN

FOR INCANDESCENT BURNERS.

For Illustration and Statement of Advantages to be gained by its use, see "JOURNAL," Dec. 1, p. 1050.

ALFRED ARCULUS & CO., Glass Manufacturers,

BIRMINGHAM.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

GEORGE WALLER & CO.,

165, QUEEN VICTORIA STREET, E.C.,

And at STROUD, GLOUCESTERSHIRE.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day. Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,

SEAHAM HARBOUR, COUNTY OF DURHAM.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THOMAS TURTON

AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,

SPANNERS, RATCHET BRACES, LIFTING JACKS,

ANVILS, VICES,

AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED,

— *v* —

"DE MARE" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

— *v.* —

"SUNLIGHT" COMPANY.

THE INCANDESCENT GAS-LIGHT COMPANY, LIMITED, HEREBY GIVE NOTICE, as follows:—

VALIDITY. The Company's Patent has been declared **VALID ON ALL POINTS** after a Fifteen-Day Trial.

NATURE OF INVENTION. The Invention was described by Mr. Justice Wills as a **"PIONEER INVENTION."**

SCOPE OF PATENT. The Patent **HAS BEEN GIVEN A WIDE CONSTRUCTION**; and it was held that the protection given by it was not confined to Mantles manufactured according to the particular prescriptions set out in the Specification.

SHAPE OF MANTLE. The Judge held that a Mantle, even if made in a different form or shape (such as the "De Mare" Fringe or Plume), **IS STILL AN INFRINGEMENT** of the "Welsbach" Patent.

"DE MARE" JUDGMENT. Judgment for an **INJUNCTION, WITH FULL COSTS**, has been given against the "De Mare" Incandescent Gas-Light System.

"SUNLIGHT" JUDGMENT. Judgment was given **AGAINST** the "Sunlight" Incandescent Gas-Lamp Company, Limited, on the question of the **VALIDITY OF THE PLAINTIFFS' PATENT.**

"SUNLIGHT" MANTLES. Last about **100** hours.

"WELSBACH" MANTLES. Last about **1000** hours.

"Sunlight" Mantles **BURN DOUBLE THE GAS** to produce the same candle power as the Incandescent Gas-Light Company's Mantles.

Users of "Sunlight" Mantles are applying to the Incandescent Gas-Light Company to **REPLACE THEM BY THEIR OWN MANTLES.**

WARNING. Users of the Incandescent Gas-Light Company's Mantles upon "Sunlight" Burners **ARE INFRINGERS OF THE COMPANY'S PATENT, AND WILL BE AT ONCE PROCEEDED AGAINST.**

COSTS. Certificates of the Validity of the Company's Patent have been granted both by Mr. Justice Romer and Mr. Justice Wills entitling the Company to Solicitor and Client Costs, which will, **IN ALL CASES, BE RIGOROUSLY ENFORCED.**

INFRINGERS. The Incandescent Gas-Light Company **WILL TAKE PROCEEDINGS AGAINST ALL PERSONS INFRINGING THEIR PATENT WHETHER**

MAKERS,
WHOLESALE DEALERS
RETAILERS
or
USERS.

Users of the Company's Mantles upon Burners not sold by the Company **ARE INFRINGERS.**

"LIMITED LICENSE" WARNING. Judgments have already been obtained against such users from Mr. Justice Chitty, Mr. Justice Stirling, Mr. Justice Kekewich, and Mr. Justice North.

FAITHFULL & OWEN,

11, Victoria Street

Westminster.

Solicitors to the Incandescent Gas-Light Company, Limited.

April, 1896.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash . . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal*; and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-UPON-TYNE.

PREPAYMENT METERS.

SIMPLE IN ACTION. POSITIVE IN RESULTS.

ROCK METER WORKS,

TELEPHONE No 2145
Telegraphic Address
AUTOMATIC MANCHESTER

THE Automatic Gas Meter 1895 Corporation Limited,

Tortworth street Strangeways

MANCHESTER.

AND AT

49 Queen Victoria Street

LONDON.

ORDERS PUNCTUALLY ATTENDED TO.

GAS COAL.

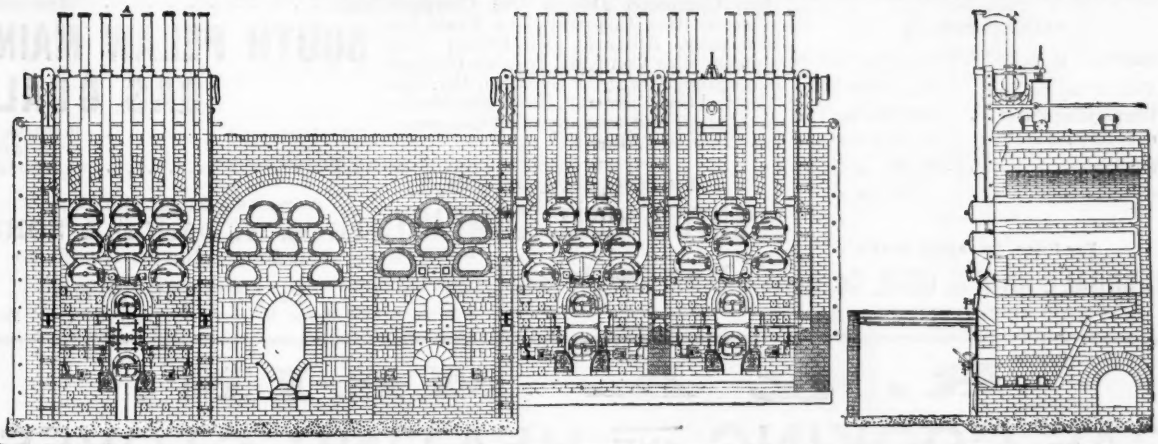
BEST

REAL OLD SILKSTONE GAS COAL,

Address THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non*

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SPENT LIMES NO LONGER WASTE PRODUCTS.

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MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY

FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY,

Strongly recommended where EXCESSIVE HEATS have to be maintained.

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WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

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Analysis made by

Messrs. J. & H. S. PATTINSON, *May 28, 1895,*

Yield of Gas per Ton	10,500 Cub. Ft.
Illuminating Power	16·9 Candles.
Coke (of good quality)	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

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Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·4 candles.
Coke	68 per cent.

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Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

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Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
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Boldon Gas Coals are supplied under contract to

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RAVENSTHORPE, NEAR DEWSBURY.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

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TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

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R. & A. MAIN,

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MESSRS. HUMPHREYS & GLASGOW

Have constructed their EUROPEAN type of

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At the following Gas-Works:—

Copenhagen	700,000 Cub. Ft.	Preston	1,500,000 Cub. Ft.
Belfast	1,700,000 ,,	Southport	750,000 ,,
Glasgow	300,000 ,,	Bath	1,000,000 ,,
Brussels	700,000 ,,	New York	1,200,000 ,,
Liverpool	3,500,000 ,,	Newburgh, N.Y.	350,000 ,,
Tottenham	750,000 ,,	Tottenham (Second Contract)	750,000 ,,
Santiago	400,000 ,,	St. Joseph, Mo.	750,000 ,,
Swansea	750,000 ,,	Brussels (Second Contract)	700,000 ,,
Brighton	1,500,000 ,,	Winchester	200,000 ,,
		Hoylake	125,000 ,,

And have now under Contract:—

Belfast (Second Contract)	4,500,000 Cub. Ft.	Norwich	1,000,000 Cub. Ft.
Shanghai	225,000 ,,	Guildford	350,000 ,,
Manchester	3,000,000 ,,	Syracuse, N.Y.	850,000 ,,
Holyoke, Mass.	600,000 ,,	Bordentown, N.J.	125,000 ,,
Edinburgh	2,000,000 ,,	Lea Bridge	350,000 ,,
Stockton-on-Tees	500,000 ,,	Newburgh, N.Y. (Second Contract)	250,000 ,,
Stockport	500,000 ,,	Coventry	600,000 ,,

In addition to which the previous Installations of The Gaslight and Coke Company under this System have a total capacity of 10,000,000 cubic feet per diem.

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United States Office, 64, Broadway, New York.

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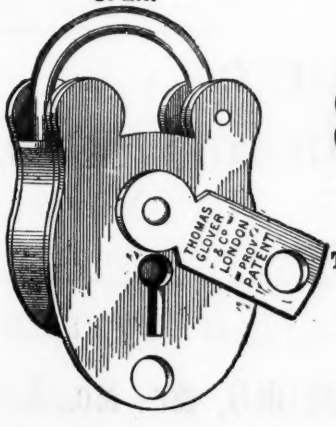

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SECURE PADLOCK

Prevents Tampering with the

CASH-BOXES OF PREPAYMENT METERS.

The Padlock is Sealed by means of a Lead Eyelet, which is impressed with Company's private mark. Eyelets easily fixed and removed by Company's Collector.

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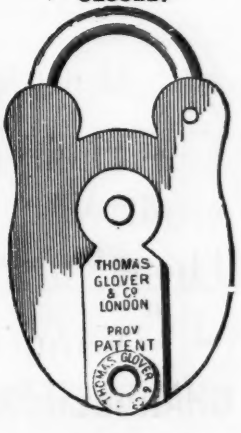

Telegraphic Address: "GOTHIC LONDON." Telephone No. 6725.

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Telegraphic Address: "GOTHIC."

BIRMINGHAM:
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MANCHESTER
37, BLACKFRIARS STREET.
Telegraphic Address: "GOTHIC."

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CONTRACTORS TO THE GOVERNMENT,

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WATER-GAS APPARATUS—A Model Plant in course of erection at their Exeter Engineering Works. Continuous Process; the best Results yet attainable.

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ESTABLISHED BEYOND ALL QUESTION.

Mr. JUSTICE WILLS says in his Judgment: "No use is made by the Defendants (the Sunlight Company) of any of the rare earths; and their choice of substances, and their method of applying the illuminants, appear to me to be as wide asunder as the poles from those contemplated by Welsbach."

Therefore any interference with our Customers by the Incandescent Company in the use of our Mantles, either on our Burners *or on theirs*, should be promptly reported. **It will at once be summarily dealt with by us, without cost to our Customers.**

THE SUNLIGHT MANTLE gives a

SOFT MELLOW LIGHT, VERY

AGREEABLE TO THE EYESIGHT, AND HEIGHTENS THE

DECORATIVE EFFECT OF PLEASANT COLOURS.

WE ARE PREPARED TO *MAINTAIN ALL BURNERS* FITTED BY OURSELVES AT A VERY LOW PRICE PER ANNUM;

AND *SPECIAL TERMS* FOR *RENEWAL MANTLES* WILL ALSO BE MADE TO THOSE WHO PREFER TO DO SO THEMSELVES.

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RANGITOL INCANDESCENT-LIGHT PREPARATION

IN POWDER FORM OR FLUID,

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SAMPLES FREE ON APPLICATION.

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NATURAL BOG ORE FROM OWN MINES.

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WORTLEY FIRE-CLAY WORKS,

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Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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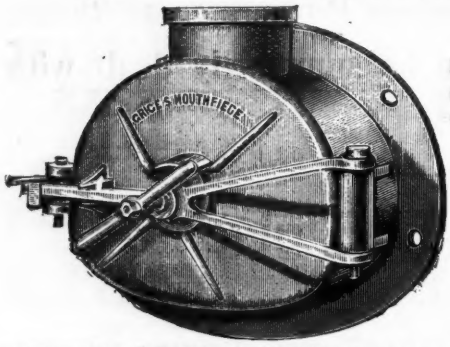
MACHINE-MADE GAS-RETORTS.

GRICE'S SELF-SEALING MOUTHPIECE,

FITTED WITH WROUGHT-IRON FRONT AND SIDE LEVERS.



Patterns for Oval, D, and Rounds, or all sized Retorts.

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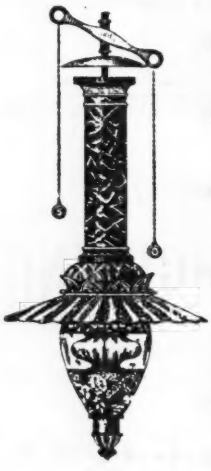
The Climax of Regenerative Gas Lighting!!



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A 280-CANDLE POWER

PLAIN IRON LAMP,

CLASS A— **55/-**

LIGHT for LIGHT less than half the price of any other Regenerative Lamp.

Manufactured in England.

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[See Illustrated Advertisement, Dec. 1, p. 1096.]

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IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

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The Apparatus has been supplied to the following Firms–

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ON THE CONTINUOUS SYSTEM

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ANY SIZE ERECTED COMPLETE AT HOME OR ABROAD.

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Patent Automatic Machinery

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DRAWING AND CHARGING GAS-RETORTS.

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[See Illustrated Advertisement, Dec. 1, p. 1051.]

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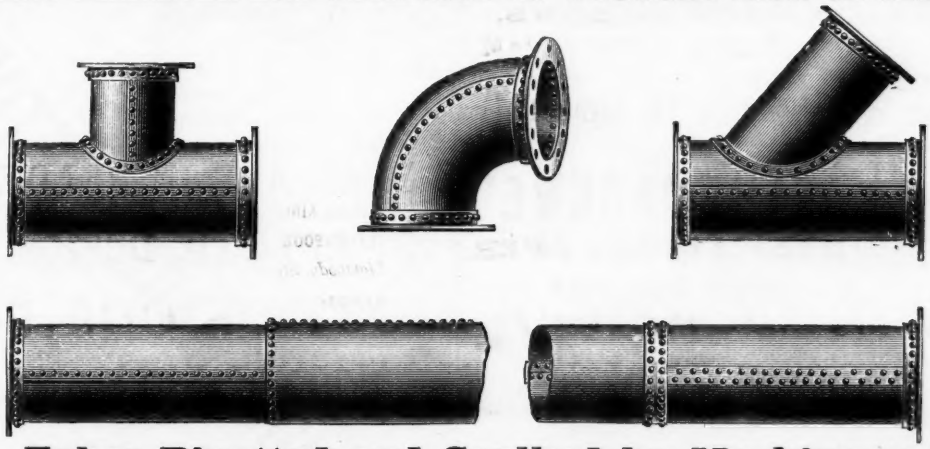
OF ANY DIAMETER AND STRENGTH IN WROUGHT IRON OR STEEL.



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ALL OUR GAS-FIRES ARE FITTED WITH OUR

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[See also Advt. p. 1276.

LONDON: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, Dec. 29, 1896.